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ORTHODONTIC TREATMENT FOR THE ELEMENTARY SCHOOL CHILD*

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OF THE many communications that have been put before this Society in the past, I must own always to have been more particularly interested in the views presented on two subjects, both of which recur constantly in our Transactions. One is postgraduate education in orthodontics, and the other the orthodontic treatment of the mass of the people in this country. It is on various aspects of this latter that I desire to dwell now.

The elementary school population of England and Wales is approximately five and one-half millions, and, as you are aware, medical and dental inspection with, subsequently, facilities for treatment, was introduced in 1907; both have made yearly advancement in scope and utility ever since. Some of us are of the opinion that the dental arrangements have lagged a great deal behind the admirable medical organization. Before being too critical I think we should be a little sympathetic toward the difficulties of the authorities, for the need of dental treatment being widespread and the onslaught of dental caries being recurrent make it appear that the dental service is a very expensive one; for instance, a child who is medically examined but three or four times in its school career of nine years will need a dental inspection at least once a year.

It may not be generally appreciated that what are known as routine medical inspections are held on the child's first admission to school, and at the ages of seven and eleven years (though some authorities do this at eight and twelve). In London the child is examined also in the term previous to its leaving school, though this is not a statutory obligation. In addition to the children of these groups, the school doctor sees only such as are put before him for special reasons. The examination is a very thorough one; about twenty children are seen

*President's inaugural address to the British Society for the Study of Orthodontics, January, 1934.

in a morning or afternoon session, and the parents are invited and expected to be present.

The dentist's annual inspection is quite different from this, since it does not take more than a fraction of a minute to decide whether or no a child requires dental treatment. Usually the children file before the dentist in turn, and in this manner some 100 to 120 can be inspected at the school in a morning or afternoon session.

During the year 1932 about 70 per cent of those inspected by the dentist required treatment. On the other hand, the routine medical inspections that were held during the same period show that less than 19 per cent required medical attention (this figure excludes dental disease and uncleanliness).

It is almost a truism that a more extensive school dental scheme would be of considerable benefit to the nation, and a wise economy in the long run, since it is obvious that where dental treatment facilities are poor, saveable teeth will become unsaveable, and the dentist will have to spend his time in extracting the remains of permanent teeth which should have earlier been made good for the patient's lifetime. I cannot do better here than quote Sir George Newman, the Chief Medical Officer of the Board of Education, who in his report for the year 1932 says: "There can be no doubt that a substantial increase in expenditure (on the dental service) would not only result in sorely needed extension of that service, at present little more than initiated in most educational areas, but it would be definitely economical in the sense of insuring the ultimate value of the preliminary inspection and treatment of the teeth. To make a child's teeth sound at eight years of age and neglect them thereafter is not, in the long run, economical but rather extravagant; to provide dental treatment effectually in area A and neglect to do so in area B is partial, inequitable and nationally ineffective; to fail to follow up the business in later school life or in adolescence is shortsighted."

I hope it will be considered the duty of the dental profession to continue to keep these matters to the fore, to the end that public opinion may be educated and a well-organized and complete dental service for juveniles be accepted as an early charge on the health service of the community.

We must, however, be thankful for the fact that of the 316 authorities who come under the Board of Education, all but two make some provision for the dental treatment of the children under their care, though in most cases the provision is admittedly inadequate and in many extremely sketchy.

Some years ago this Society had an interesting paper read by Mr. Frank Steadman in which he reminded us that those who were economically in a position to receive elaborate orthodontic treatment were but a small fraction of the total child population. I was convinced then, as now, of the soundness of this view, for leaving out of account any question of direct payment to the dental practitioner, the expense of frequent journeys and the loss of time must remain very real deterrents to any parent, more especially to those who are wage-earners.

In the discussion on this paper, the view was expressed by Mr. Harold Chapman and others that orthodontics for the masses must be considered as secondary to the adequate treatment of dental disease, from which we must infer that a public dental officer is entitled to give time to orthodontic treat-

ment only if he is able satisfactorily to treat dental decay and oral sepsis in the children allotted to him. Of course, his ability to do this would depend on the number of children so allotted. If we take the ratio of school children to dental officer, we find that the number for England and Wales is 9,000 per dental officer, but that in some areas the school population is as many as 20,000 per official dentist. Essayists and speakers before this Society and elsewhere have given figures varying from 2 to 50 as the percentage of orthodontic defects. This divergence of views draws attention to the need for a standardized investigation of this question by our profession.

I am taking this opportunity to recant views which I gave to this Society nearly fifteen years ago. In a paper read in 1919 I made a plea for the establishment of an orthodontic center in Central London, where all school children who required treatment could be referred, and where, in addition, orthodontic instruction could be given to dental surgeons. For the past two years I have acted as dental adviser to the London County Council and have been enabled to look more closely into matters which then I only gazed at from outside. While possibly in other areas it may be feasible to centralize dental or orthodontic work, I am convinced now that in a district the size of London, the ideal is for any orthodontic treatment to be done through the cooperation of the dentist working at the local treatment center.

May I briefly here tell you of the dental arrangements made in the metropolis? It may be of some interest, for, indeed, I find that most of my London confreres are unaware of the magnitude of the dental commitments of the London County Council, which are by no means limited to children.

There are about seventy centers where dental treatment is carried out for school children, the work being done by ninety-seven part-time dentists, of whom sixty-seven act as inspecting dentists in the schools. During 1932, 2,462 inspecting sessions were held. These ninety-seven part-time dentists are equivalent in the number of sessions they give to the work to forty-three full-time officers. There are in addition to the day scholars 9,000 children in boarding schools, known officially as residential schools or children's homes. All of these are inspected by a dentist twice a year, and the necessary treatment is carried out for them subsequently.

The Council also controls general and special hospitals having a total of approximately 40,000 beds, and the mental hospitals in addition. With the exception of the fever hospitals, where the patient's stay is usually short, arrangements have been made for a dentist to visit—usually weekly or twice weekly—all these institutions.

In addition to routine treatment, dentures are supplied at public expense for those cases where the medical superintendent of the hospital considers that such provision is a necessary ancillary to the medical or surgical treatment of the patient. The dentures are either supplied by the visiting dental surgeon or constructed under his direction in the Council's dental laboratory.

I must also mention the Plastic Surgery Unit directed by Sir Harold Gillies, which does such beneficent and beautiful work with the cooperation of our members—Mr. A. E. Hardy and Mr. A. L. Fraser.

This is all on the public health side, but dentistry also figures in the pro-

gram of the Public Assistance Committees, and under the education officer classes are held for the training of dental mechanics in various evening institutes.

Limiting ourselves to the children, it will be noted that the seventy treatment centers, where dentistry is practiced, are dotted all over the county. The aim is to have each one geographically convenient to a group of schools, for it is only by arranging for treatment to be easily accessible for the child and its parents that we are able to get a good proportion of the work done. The Council's policy is to make use of existing institutions where possible, and many of the treatment centers are domiciled in dispensaries and in well-known hospitals. Others are established in small suburban houses, only distinguishable from their neighbors by a name board and the ever open door.

At present no mechanical orthodontic treatment is carried out at any of these treatment centers. Such cases as the dentist feels he is unable to undertake without some form of appliance are recommended to go to one of the five London dental schools or to the Eastman Clinic. Before criticizing this routine, we must remember that if the Council were able and willing to treat all its own orthodontic cases, the dental schools would be hard put to it to find material for the instruction of their students in this subject.

However, I am hopeful that in the near future specially selected orthodontic cases may be treated at the dental centers with appliances made at the Council's dental laboratory. Such an arrangement should prove of great benefit to those parents for whom the expense of long and frequent journeys across London is a great consideration, and should make an interesting variation from routine for the dental officer.

It is difficult to restrain one's enthusiasm in speaking of the general conditions under which the children live in the twenty-odd residential schools to which I have already referred. These beautiful estates situated for the most part in the Home Counties outside the County of London proper are filled mostly with happy and healthy youngsters, and it is here that the dental surgeon has his greatest opportunity. For, given the combination of a well-balanced dietary, training in oral hygiene, discipline, and regular professional attention, it is possible to send these youngsters out into the world with a proper dental equipment. It is not inappropriate to quote here from the presidential address delivered in 1910 by Dr. Sim Wallace—he then said: "I dream of the day when children may be permitted to live under environmental conditions which will not only prevent the irregularities of the teeth, but will also prevent the ill health and its results which are so painfully depicted on the faces of four-fifths of the children of the present day."

Perhaps Dr. Sim Wallace might consider that we in London are on the road toward this Utopia.

DISCUSSION

Mr. Badcock, **in proposing a vote of thanks to the President for his address, assured him that in all the previous presidential addresses through which he had looked, he had not found one more valuable, interesting and instructive. Coming as it did with the President's authority as Adviser to the London County Council and as President of this Society, it should carry weight in quarters where propaganda was needed. It covered a wide field and was not a paper for discussion, but members had learned much from it, and few of them had known that the Council was nearly as active in treating the teeth of children.**

ORTHODONTIC DIAGNOSIS

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ORTHODONTIC procedure, to a great degree, has remained the same for the past fifteen years. It is true that different forms of wire, locks, and mechanical appliances have been introduced, but the basic principles have changed very little. The purpose of this paper is not to attempt a presentation of anything startlingly new in the field of orthodontia; it is rather my desire to call attention to a few salient points which I believe might be of benefit toward better diagnosis. Most orthodontists will agree that each case is a case unto itself; no two cases treated in like manner will respond exactly alike. The more cases one treats, however, the greater will be one's experience, and experience should give one knowledge. By presenting to the profession our unsuccessful, as well as our successful cases, it may be possible to shorten the paths of experience and at the same time give us even greater knowledge.

The treatment of Class 1 cases may present many problems. In my opinion, there is no orthodontic case which can, upon examination only, be designated as a simple case. Often cases which appear to be simple reveal themselves to be the most difficult. On the other hand, cases appearing to be difficult may turn out to be the most satisfactory ones. It is not uncommon for an orthodontist of outstanding ability to find after treating a case for some time that his method of treatment is erroneous.

Fig. 1 shows casts of the teeth of a boy thirteen years of age. The patient was relatively small in stature for his age; his general features were small. The mandibular left second premolar had no space in which to erupt; the mandibular right second premolar had partial space for eruption; and the mandibular anterior teeth were somewhat crowded. In the maxilla the right central and lateral incisors were in lingual position and the canines had insufficient space. In this case there was one of two procedures to follow: either to expand the arches and make spaces for all the teeth lacking space or to extract four premolars and adjust the remaining irregular teeth. To aid me in reaching my decision I reconstructed the jaws in plaster, placing all the teeth in proper position. This procedure is purely mechanical and cannot give true information regarding the future development of the jaws; nor can it project the possibilities for a harmonious relation between the teeth and the features of the individual. However, after careful analysis, I chose to expand the arches and make spaces.

Fig. 2 shows the case after a little less than three years of treatment. The relation of the teeth to the general appearance of the face is fairly good; although at times when I look at the patient, it does seem to me that with less tooth structure his appearance would be improved. At the present time, various retaining bands are holding these teeth in position, but I have a distinct feeling that when these bands are removed the case may collapse within a year.

Read before the Great Lakes Association of Orthodontia at Toronto, Ontario, May 7, 1934.

Fig. 3 shows models of a patient fourteen years of age. It shows a lingual version of a maxillary left rotated canine and a lateral incisor. The maxillary right lateral incisor is in lingual position and the right canine has insufficient space. The median line is off center. The general appearance of the jaws and teeth, the distorted development in the maxillary anterior region, and the small amount of overbite gave me the feeling that this case would be rather difficult to treat successfully. Through a combination of appliances the results were obtained as shown in Fig. 4. These casts were made fifteen months after all retaining bands had been removed. Up to the present time this case can be called a success. I do not believe that it will relapse.

Fig. 5 shows models of a patient ten years of age. This is an open-bite case. Orthodontic appliances were used, and the teeth after some difficulty were

Fig. 1. Fig. 2.

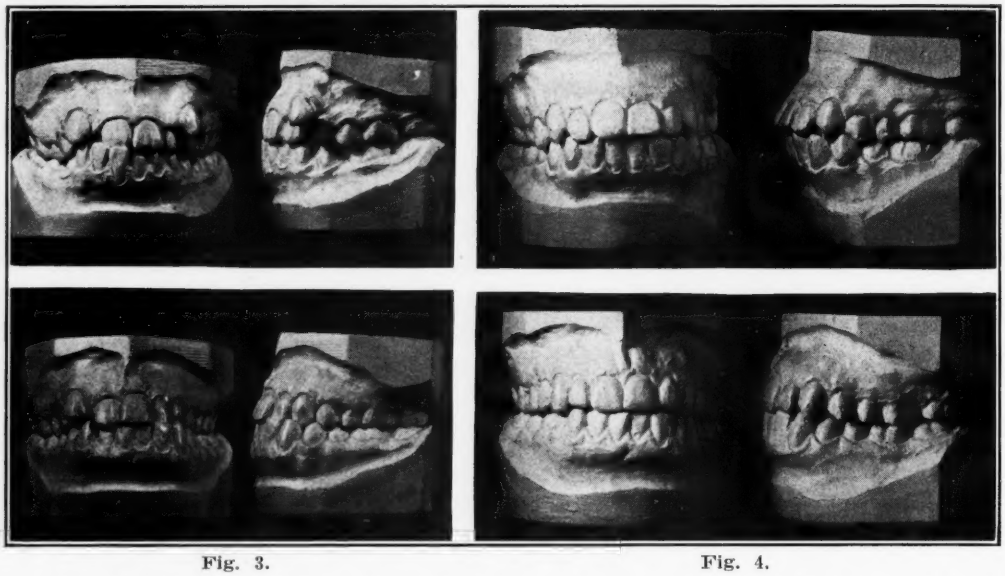


Fig. 3. Fig. 4.

Fig. 1.—Casts of teeth of a boy thirteen years of age. The two mandibular second premolars have insufficient space in which to erupt. In the maxilla the right central and lateral incisors are in lingual position and the canines have insufficient space.

Fig. 2.—Same case after a little less than three years of treatment. Retainer bands are holding the teeth in position.

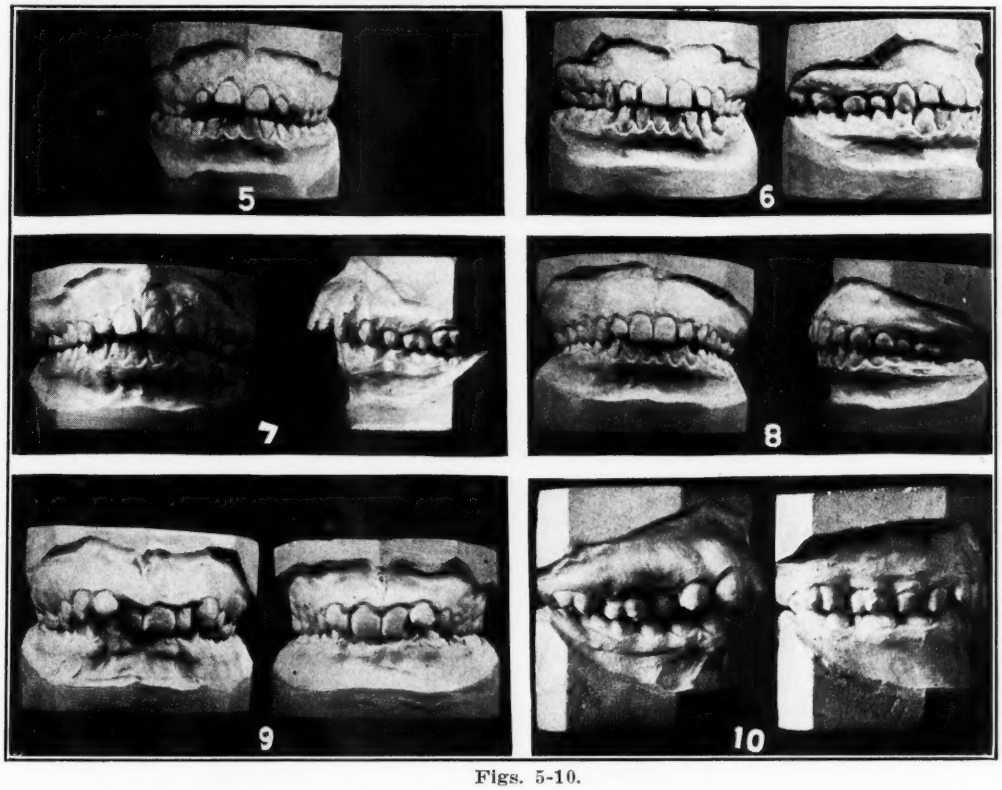
Fig. 3.—Models of a patient fourteen years of age, showing lingual version of a maxillary left rotated canine and a lateral incisor. The maxillary right lateral incisor is in lingual position, and the right canine has insufficient space. The median line is off center.

Fig. 4.—Casts of case shown in Fig. 3 fifteen months after all retainer bands had been removed. A little more than two years of active orthodontic treatment was given in this case.

brought into occlusion, where they were retained for about a year. Within six months after all retainers were removed the case looked worse than before treatment was begun. Two maxillary first premolars were then extracted and the case was retreated. No retainers were used after the second treating, and Fig. 6 shows the condition of the teeth at the age of eighteen years, about two years after all orthodontic treatment had been discontinued. Would it be correct to call this a semisuccessful case, or shall we say that the method of treatment was wrong?

The casts of teeth of a patient fifteen years of age are shown in Fig. 7. At

first glance one would call it an open-bite case. Both maxillary second molars are in buccal position. I believe that if these two molar teeth were placed in their normal position in the arch the opening in the anterior part of the mouth would be enlarged. The two molars in question were extracted and the third molars allowed to occupy the positions normally occupied by the second molars. Fig. 8 shows the occlusion which was finally established. No retainers were placed on this case. Nine months after all appliances were removed the case remains as in Fig. 8. It is my feeling that this case is not a true open-bite case, whereas the one shown in Fig. 5 is. In both cases it is apparent that extraction of teeth has aided in producing a better appearance of the individual. I am



Figs. 5-10.

Fig. 5.—Models of a patient ten years of age. Open-bite case.

Fig. 6.—Same case, patient eighteen years old, two years after all orthodontia treatment had been discontinued. No retainers were used on this case.

Fig. 7.—Casts of teeth of a patient fifteen years of age. Both maxillary second molars are in buccal position. The author believes that this is not a true open-bite case.

Fig. 8.—Same case shown in Fig. 7, nine months after all appliances had been removed.

Fig. 9.—Models of two distinct types of deep overbite cases. Anterior views appear to be quite similar—deep overbite, retruding central incisors, and irregular lateral incisors.

Fig. 10.—Buccal views of the two types of deep overbite cases. The one on the right has a normal anteroposterior relation; whereas the one on the left has a distinct posterior relation of the mandibular arch.

not, however, even suggesting that the extraction of teeth is the panacea for treatment of open-bite cases. I wish to call attention to the fact that in the first case the teeth extracted were in alignment and occlusion, whereas in the second case the teeth extracted were out of alignment and not in occlusion.

I shall show two distinct types of deep overbite cases: the one relatively easy to correct, the other very difficult. Fig. 9 shows models of two cases: the

one on the right represents the teeth of a boy nine years of age, the one on the left those of a boy twelve years of age. Viewing these cases anteriorly they appear to be quite similar—deep overbite, retruding central incisors, and irregular lateral incisors.

Fig. 10 shows buccal views of the same cases. The one on the right has a normal anteroposterior relation; whereas the one on the left has a distinct posterior relation of the mandibular arch. Treatment for correction of these cases will not be the same; the results of treatment in the posterior case will be much

Fig. 11.

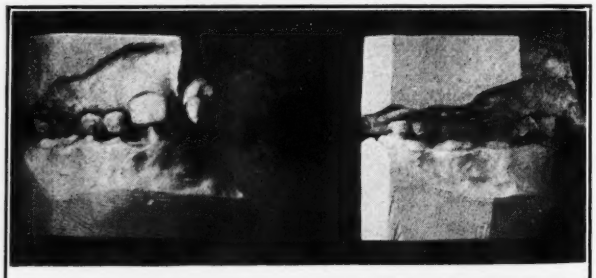


Fig. 12.

Fig. 13.

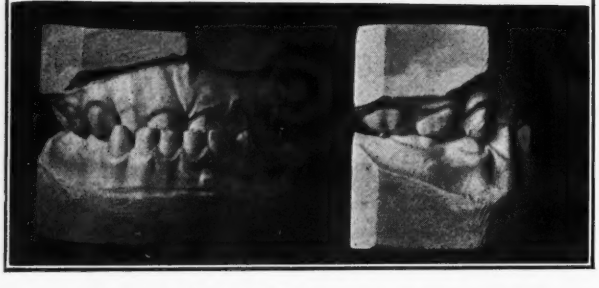


Fig. 11.—Casts of a patient eight years of age; a mixed denture, with protruding maxillary anterior teeth and a posterior relation.

Fig. 12.—Casts of a patient five years of age; the right side reveals a cross-bite of all the buccal teeth.

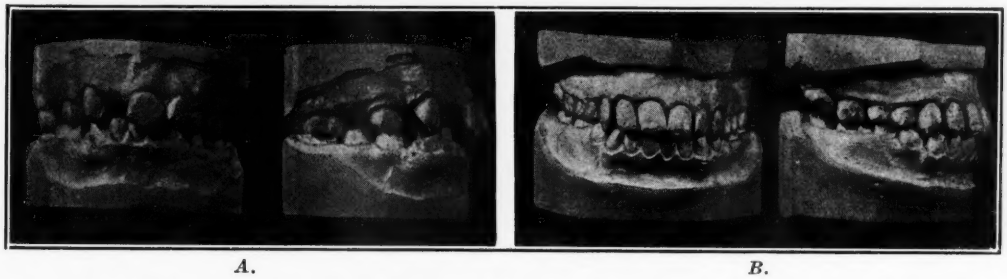
Fig. 13.—The teeth of a patient three years of age with a lingual version of the maxillary anterior teeth.

more favorable than the results in the normal relation. The results obtained in the treatment of deep overbite cases where the anteroposterior relation is normal, are usually disappointing.

At all times the orthodontist should be honest with himself and equally honest with his patient. If the prognosis is unfavorable or if there is a possibility that the case may need retreating, the patient should be so informed. In Figs. 11, 12, and 13 will be found striking examples of cases which after a short period of treatment may need more treating at some future date. Fig. 11

shows casts of a patient eight years of age; this is a mixed denture, protruding maxillary anterior teeth with a posterior relation. Fig. 12 shows casts of a patient five years of age; the right side reveals a cross-bite of all the buccal teeth. Fig. 13 shows the teeth of a patient three years of age with a lingual version of the maxillary anterior teeth. In all these cases there is a possibility of malocclusion in the permanent dentition.

I shall now touch upon the subject of impacted anterior teeth. All too often orthodontists surgically uncover so-called impacted teeth of patients from nine to sixteen years of age. They then sink gold pins into the teeth and attempt to force eruption by a downward pull. This procedure is a long tiresome treatment



A. *B.*

Fig. 14.—*A*, Models of teeth of a patient ten years of age. On the right side of the maxillary arch there is insufficient space for the second premolar, canine, and central incisor. All three teeth are present in the jaw.

B, The finished case, five and one-half years after the supernumerary teeth were removed. Six months prior to the making of these casts all appliances were removed.

Fig. 15.—Two supernumerary teeth in addition to the impacted, rotated, and malposed canine and central incisor.

for the patient. It is my belief that in most of these cases, if sufficient space were made, the so-called impacted tooth would erupt at a good time and in fair position.

Fig. 14*A* shows models of teeth of a patient ten years of age. On the right side of the arch there is insufficient space for the second premolar, canine, and central incisor. All three teeth are present in the jaw. The x-ray pictures in Fig. 15 reveal two supernumerary teeth in addition to the impacted, rotated, and malposed canine and central incisor. The canine tends to erupt lingually to the root of the lateral incisor with the cusp directed slightly distal between the lateral incisor and the central incisor. The central incisor tends to erupt rotated and in lingual position.

In this case the two supernumerary teeth were removed and the tissue was permitted to heal. Orthodontia treatment was started later, to make spaces for the unerupted teeth. Within two years the right central incisor erupted lingually; it was rotated at approximately 75 degrees. Six months after the eruption of the central incisor the right canine erupted rotated, and in lingual position. No downward pressure was exerted upon these two teeth; after they had erupted they were moved to their proper place in the arch and were then rotated. Fig. 14*B* shows the case five and one-half years after the supernumerary teeth were removed. Six months prior to the making of these casts all appliances were removed.

I am aware that the right central incisor is still in a slightly rotated and tipped position. It was left in this position because of the fact that when the tooth was tipped into its proper angle all the anterior teeth began to rotate and protrude. This effect was much more unsightly than just a tipped central incisor. Perhaps all impacted teeth will not erupt unaided, but I do believe that after sufficient space has been made a reasonable amount of time should be allowed for physiologic eruption. A little more watchful waiting will prove that Nature is kind to us.

CONCLUSIONS

1. In my opinion, there is no orthodontic case which can, upon examination only, be designated as a simple case. Often cases which appear to be simple reveal themselves to be the most difficult; while those appearing most difficult turn out most satisfactorily.

2. The procedure of reconstructing in plaster the teeth and jaws as an aid in diagnosis is purely mechanical and cannot give accurate information regarding the growth possibilities.

3. There is more than one type of open-bite case, and methods of treatment and results obtained will vary.

4. There are two types of deep overbite cases; one type very difficult to correct, the other being more easily corrected.

5. There are certain types of cases with deciduous and with mixed dentures which should be treated, but which always contain the possibility of needing retreating after all the permanent teeth have erupted.

6. So-called impacted teeth in patients between the ages of approximately nine and sixteen years should not have pins sunk into them until sufficient space has been made for them and Nature given a reasonable amount of time to bring them down.

Both biologic and mechanical aspects of orthodontia are still discussed with great fervor. Neither aspect alone holds the complete answer to our problems, but successful orthodontic diagnosis should be based on a thorough knowledge and coordination of both. With the use of all the biologic and mechanical principles at our command, orthodontic procedure is still empirical, but that empiricism need not deter members of the profession from doing much good if in diagnosing they will reinforce their biologic and mechanical knowledge with good common sense.

A BIOLOGIC CONSIDERATION OF THE PRACTICE OF ORTHODONTIA*

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EACH experimental science may be studied from two fundamental aspects, namely, the principles upon which it is based and the method of their successful application. Orthodontia is a true experimental science. Its practice, formerly based upon trial and error, has become greatly enlarged through the study of the closely allied medical subjects.

Those divisions of knowledge which are concerned with all the complicated phenomena of living organisms, whether of microscopic or macroscopic appearance, are grouped for convenience under one head—the science of life or biology. It is not enough, however, to confine the classification to one word—subdivisions are necessary in order to define clearly each field. Thus the medical sciences are grouped into those which pertain directly to the art of medicine and those concerned with the science of medicine. Similarly, in the orthodontic field there are grouped those subjects dealing respectively with its art and with its science. Of the two, the factors pertaining to treatment have been developed further than those pertaining to etiology and to diagnosis. The clinical requirements account for this unequal growth, but the fact becomes daily more evident that therapeutics, unless based upon sound knowledge of the fundamental concepts of biologic principles, fails to meet adequately the demands that arise in the successful conduct of a practice. It must be realized, also, that bone growth, which is cellular activity, depends upon supplying regularly the various necessary chemical elements contained in a well-regulated diet. Furthermore, unless the habits of work, play, rest, and hygiene are supervised, there is an interference with the proper assimilation and utilization of food by the body.

Given an adequate nutrition and corresponding removal of waste products, the growth of each cell or aggregate of cells will proceed in a manner referred to as normal. If either of these factors is reduced to the borderline minimum, then the result will be a delayed or stunted growth. This accounts in the tooth development for hypoplasia. It is at once evident, then, that the knowledge obtained from the study of chemical biology is of paramount importance in the elucidation of many of the problems of morphology.

This science of form may be considered not only from the dental standpoint but also from the standpoint of the paradentium, the maxilla, and the mandible. Form is developed from the need of economic function. That is to say, the various types of dentition found in carnivores, herbivores, and omnivors are the direct result of the different kinds of food which each species requires. Abnormal form may result from environmental conditions, such as disease or accident, or from an ill-defined hereditary influence. It is the correction of abnormalities in form with which the orthodontist is concerned. For

*Presented to the American Board of Orthodontia.

by the word "form" is meant the relation of the teeth not only to each other but also to their supporting structures. Thus is function served to best advantage, since form, as stated before, is developed from the need of economic function, economic in the sense that there is a minimum waste of energy for the purpose of efficient mastication.

Our present knowledge of the growth processes in the animal kingdom, including man, has been developed from observation on both man and experimental animals. It has been shown, for example, in the white rat that the curves of normal growth, as measured by periodic weighings, show a gradual trend upward, as a result of the increment of tissue. This is modified by periods of acceleration and retardation. Under the influence of various definite diets the period of acceleration is shortened and that of retardation correspondingly lengthened. For example, when a food mixture is made up in which the protein is deficient in certain essential amino acids, the normal increment of tissue is retarded to a considerate degree. Indeed, the animal may die if the restrictions are too severe. Similarly, when the food formula lacks or is low in any of the various vitamins, the response by the rats is very striking. The hair quickly loses its glossy sheen and becomes ragged and unkempt. Restlessness is marked, and frequently the females resort to cannabilism and devour their young.

When the teeth and jaws are examined, many noteworthy features are evident. Malocclusion of the maxillary and mandibular central incisors frequently produces the death of the animal. The malocclusions may be merely an asymmetrical development of the jaws; or the incisors, by becoming brittle, are easily broken off and thus fail to occlude with the corresponding teeth in the opposing jaw. It is seldom that the molar teeth become malposed. They develop lesions similar to dental caries, as Simmonds, McCollum, and Marshall have shown. Somewhat analogous results have been obtained in guinea pigs, monkeys, and dogs. These examples are cited to show the tremendous influence a deficient diet may exert on experimental animals.

Interesting as these experiments are, it is somewhat difficult to evaluate these results in terms which are directly applicable to man. Furthermore, no comprehensive data are available which take into account the influences on growth and development exerted by heredity. The deficient diets are but one factor in environment, and have only an indirect influence on the laws of natural selection and variation. It is only when dietary experiments are conducted on animals over a relatively long period that the relation between the environmental factors to heredity can be measured.

Compare next the available data on any given number of orthodontic cases. Here the difficulties in the interpretation of the etiologic factors are greater than in animal experiments. It is not the usual experience in a practitioner's case reports to have available the models of the patient, the parents, the grandparents, and the great-grandparents! Yet this is hardly a start if the laws of heredity are to be studied and applied. Even the data on the habits of the patient may be incomplete. Thus, not only are the various important factors in heredity lost to the record, but oftentimes the more readily available data on environmental conditions are equally fragmentary. It is not in this gen-

eration nor in the next that the influences of heredity on malocclusions will be known. In spite of this statement there are occasional instances in which it has been possible to trace directly a definite anomaly through three generations. Comparison with results in the experimental field is at present the only method available for the formation of a workable hypothesis for etiology, but this much may be said, that the etiologic factors reflect their influence not only on the growth of the animal but also on the individual response made by the cell.

The biochemical and biophysical concept of cell growth assumes the following sequence of events. Each unit is limited in size by a continuous and limiting membrane, the cell membrane. As a result of cellular activity, substances are being continually formed in the protoplasm. Gradually there is accumulated a higher concentration of colloids and crystalloids which is greater than that in the substance outside the cell. The degree of concentration is controlled by the phenomena of diffusion and osmosis. On account of this slight difference in concentration, new material is drawn through the cell wall and other substances are passed out to the medium surrounding the cell. This constant interchange, in which new material is introduced and the products of cell metabolism are thrown off, accounts for the gradual enlargement or growth of each unit. Coincident with this, a new sequence of events occurs which later produces cell division. Then the process repeats, and the smaller cells grow until they in turn attain their maximum function. Cell growth and cell division are properties of all living matter. It is readily seen, therefore, that unless the cells receive an adequate food supply and maintain a corresponding removal of their waste products that there is a definite interference in both their growth and function. The growth stimulus inherent within the cell is partly the response which is made to a favorable environment and also is governed by the hereditary characteristics responsible for form, size, and function.

Additional means are available for promoting a favorable environment to the cell. When its function is considered, it is recognized that any stimulus which tends to increase normal function reacts favorably upon the cell metabolism. If, however, the stimulus is increased to a point beyond normal function, then fatigue and even pathologic changes supervene. This has been shown to be a rather common factor in the etiology of some types of malocclusions. Roger's study of habits of tongue placements, lip-sucking, faulty posture, and finger-sucking has indicated than an unusual muscular strain was produced. This was of sufficient intensity to account for malocclusion of the teeth and faulty relation of the jaws. To overcome this condition several exercises were devised which served to counteract this muscular strain and fatigue.

It was the usual thought among practitioners of general dentistry that orthodontic treatment should not be commenced before a malocclusion was definitely established. Consequently corrective measures could not be indicated before the patient attained the age of about twelve years. This was a faulty hypothesis, for the idea seemed to prevail that developmental processes in the jaw were only remotely related to adult occlusion.

In contradiction to this, the orthodontist realizes that it is as important to guide the various stages of development of the jaw as to visualize the complete adult dentition. He sees the necessity of affording the forces of nature

an opportunity to aid in the processes of growth. As an example of this is mentioned the corrective procedure outlined by Rogers in dealing with a case of neutroclusion. He uses a lingual wire, supplemented by adjustments made at relatively long intervals. Thus a corresponding correction was effected in the maxillary arch by the influence of the mandibular teeth. The means of accomplishment was simple—merely the exercise of muscles of mastication. There were no clumsy appliances, unsightly and unhygienic, which interfered with the functions of the lips and cheeks, but only a well-designed set of exercises. It is well recognized that the lips and cheeks limit and guide the positions of the teeth. When these underlying muscles are stimulated by the type of exercise referred to, the orthodontist makes use of a powerful aid in the treatment of certain types of malocclusion.

The local stimulus produced by an orthodontic appliance may easily excite an overstimulation of the tissues concerned. Instead of helping the case it may hinder it. In explanation of this point Marshall has reported in his research on monkeys that when a reciprocal movement is produced on two maxillary permanent central incisors, using 0.030 round wire gold platinum alloy and spring tempered, that sufficient pressure can be applied to produce pulp necrosis by strangulation. The apex of the tooth was forced through the alveolar plate, thus cutting off the capillary circulation in both pulp and peridental membrane. Although excessive pressure was used in this particular instance, it is pointed out that similar conditions might arise in the treatment of a case in which the banded teeth under undue pressures are held in a viselike grip for relatively long periods of time. There is, however, no definite line of demarcation between a pressure which causes bone and tooth resorption and concomitant necrosis of soft tissue, and a pressure which is sufficient only to excite compensating resorption and apposition. In the one case, the pressure may be sufficient to compress the peridental membrane to such a degree that the blood supply is restricted, and thus there is an interference with its nutrition. In the other case, the blood supply is not lessened. In fact, the opposite condition arises; namely that new blood vessels appear in the membrane, thus aiding those processes concerned in the breaking down and rebuilding of bone. New capillaries account for the development of mesenchyme cells whose function is to resorb the tissues on the positive side of the pressure and to rebuild on the negative side.

The degree of cellular response in the tissues of the paradentium depends upon the amount of pressure, and its method and frequency of application. The planning of an orthodontic appliance is a problem merely of the physics of mechanical force. After the appliance has been adjusted and placed in position on the teeth, the problem becomes infinitely more complex. It is a study of the biophysical and biochemical response to a mechanical force. The tissues, however, do not react to the same degree even when the stimulus in several cases is identical. It is assumed that the reason for this lack of comparative uniformity is due to differences in the general health and to variations in muscular and bony development.

As an example of this, attention is again invited to the research on bone changes which is being conducted by Marshall at the University of California. In this work various types of appliances are fitted to the teeth of monkeys

(Macacus rhesus) and the resultant tooth movement studied at the conclusion of the experiment by means of a series of microscopic sections cut at different positions in the jaw.

The roentgenographic evidence of bone and tooth resorption is not demonstrable to the same degree as in clinic cases. The histopathologic picture found in animals on an adequate diet is quite different from that observed in the tissues of animals on deficient diets, and may be summarized briefly. This study shows that the amount of resorption varies to an extent hitherto unsuspected. It has been observed that when animals are maintained on a diet adequate to normal growth, the outline of the root periphery undergoes changes in accordance with the amount of pressure applied to the tooth. When the tension is removed, new tissue is rebuilt, and the form of the root thus restored; but when the pressure is relatively strong, the capillary circulation in both pulp and peridental membrane may be reduced to such a degree that partial necrosis of the tissues in the areas of greatest pressure occurs. Under these conditions, the process of rebuilding the resorbed tissues is greatly delayed, and in fact may not occur. This is without regard to any dietary influences.

When animals are maintained on diets somewhat deficient in vitamin A, the resorptions are greater in extent and are slower in being repaired. No data have been cited to indicate that one type of appliance is more liable than another to produce these lesions.

The tissue reactions incident to tooth movement show more similarity to those normally found during the shedding of deciduous teeth than to those associated with infections from pulp or paradentium. This observation is important because it marks a line between physiology and pathology. The reparative processes are not complicated by the phagocytic action characteristic of removal of infection. That the process can be produced experimentally indicates that it is within the power of the orthodontist to reduce the hazard of resorbed roots.

The application of this research to orthodontic practice is at once apparent: animals which are gaining normally in weight and present no frank evidence of malnutrition respond satisfactorily to the various types of treatment followed in the practice of orthodontia. In evaluating the data dealing with health, attention must be given also to the weight, height, age, and sex relationships. None of these taken separately serves as an index for normal well-being, but when studied jointly, provide the necessary facts from which reliable conclusions may be drawn.

A biologic consideration of the practice of orthodontia is based primarily upon cellular activity. The local stimulus supplied by a well-designed appliance accelerates normal growth of the tissues concerned, but overstimulation defeats this end. The orthodontist must understand the relation which exists between pure mechanics and biomechanics. He should realize the effect produced by external force on living cells. For only cellular activity can bring about the desired change in the position of the teeth. This new alignment should result in an established normal structure, retention, and function.

THE MECHANICAL PHASE OF ORTHODONTIA*

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IN THE past few years we have been hearing at our meetings and have been reading in our scientific periodicals a great deal more about the biologic than the mechanical side of our problem. In fact a study of the current orthodontic literature reveals a decided trend away from the mechanical phase of orthodontia. There are probably two reasons for this. In the first place, so much has been written about mechanics and appliances that we are probably quite well advanced in this subject, and second, the biologic side of the science has become so much more important that the mechanical side has been pushed into the background.

This shows that we are on the right track, but the importance of mechanics in orthodontia should not be minimized. We are still dependent on mechanical appliances for our results, and a thorough understanding of the subject is of such importance that it seems needless to emphasize it. Every effort should be made to establish the etiology of a case in order to decide intelligently whether and when appliances are necessary. After this has been decided, but before placing any appliances, we must formulate in our mind what tooth movements are necessary in order to apply mechanical forces in the correct directions. At this point we might get into long discussions about the relative merits of the various methods of diagnosis (I am of course referring to tooth movement diagnosis). Perhaps it is because I am more familiar with the work of Dr. Stanton along these lines, than with the work of any of the other investigators, but I am convinced that his approach is more helpful to me than any other plan or method. The criticism which his work has received as being too accurate to be applied to a biologic problem is ridiculous. Arch predetermination has been flayed as applying a "foot rule to nature," sometimes by the very men who themselves use a ready-made Hawley chart for the same purpose. All the talk in the world about orthodontia being a biologic problem (which every one agrees that it is) does not affect the fact that we are still applying mechanical forces to produce tooth movement and to change arch form. Before doing this we must have a preconceived idea of where we want to move the teeth and what general arch form we want to establish. Stanton's critics would have us believe that some vague mental picture of this is of more value than an accurate graphic representation. The mere fact that this may be too accurate for actual accomplishment has nothing to do with the question. Furthermore, some of his critics still feel that there is, according to this method of diagnosis, just one arch into which a given set of teeth can be arranged. This may be a fact in a perfect set of teeth where the total tooth substance of the maxillary arch is perfectly matched with that of the mandibular arch. As

*Presented to the American Board of Orthodontia.

a matter of interest, I remember proving this point while associated with Dr. Stanton. We found an occlusion which was nearly perfect and determined the mesiodistal diameters of all the teeth. These measurements were then set up in the occlusograph (that word has offended the sensitive natures of many orthodontists), and with no comparison of any kind to the actual set of teeth an arch was designed. My recollection of the outcome, and I am sure it is vivid enough to be accurate, was that the determined arch varied so little from the actual arch that the difference was negligible. In other words, there was just one arch into which those teeth would perfectly fit. This experiment, however, should not be misleading. The average set of teeth in malocclusion is not as perfectly matched as these. Generally the mandibular tooth material is too great for the maxillary, and either the mandibular anterior teeth must be left a little crowded, or the maxillary anterior teeth must be spaced. This means that the links in this occlusograph (which links represent the individual mesiodistal diameters of the teeth) must be separated somewhere; and when once this chain is broken, there is much more latitude in the predetermination of the arch. As a matter of procedure, the occlusograph is set up on transparent cross-section paper, with the map of malocclusion below it, and the underlying map of the maloccluding teeth is used as a guide in setting up the arch. In using it as a guide we try to establish an occlusion with as little change as possible from the existing arch form. In other words, a long narrow arch is not changed into a broad flat one, or vice versa. In fact, even though malocclusion exists, when the map of malocclusion has been made and the axis of symmetry established, there are generally many indications as to the general arch form into which to arrange the occlusograph. Certainly this method of arch predetermination should not be compared with any set of ready-made charts, or the Ponts' system of measurements which has been conclusively proved faulty by Dr. Stanton.

Having spent some time in praising Dr. Stanton's method of diagnosis, I may have created the impression that I regard it as perfect, and that it is necessary in every case. If I have created such an impression, it is a false one. As for its perfection, the only cases in which I have sometimes disagreed with the map placements, as arrived at by superimposing the centroid and axis of symmetry of the map of occlusion over the centroid and axis of symmetry of the map of malocclusion, have been certain types of distocclusion. It is a small point and probably would have no bearing on the actual treatment of the case, and I shall not go into the discussion of it here. As for the necessity of making maps of every case treated, I do not believe that it is at all necessary. I think that after one has made enough of these maps of all kinds of cases, he is able to visualize the movements in a large percentage of cases better than he ever could have done without this training, and it is necessary to map only the difficult cases. This may be regarded as an egotistical statement, but I do not mean to infer that I am sure I can visualize better than someone else. I merely mean that I am sure I can visualize better, having had the training, than I ever would be able to do without it. And then, in case of doubt, the maps are made. I am not advocating this plan of procedure. Perhaps it would be better if every case (except the deciduous dentures) were surveyed. But

I do not do it, and I must admit it. Any diagnostic scheme should be used as an aid to common sense and good judgment based on experience, not as an absolute law which cannot be violated under any circumstances.

I believe Simon has done more for the standardization of orthodontic photography than any one else. These photographs make good records, whether they have any real diagnostic value or not. It would seem to me that the profileograph, as described by the late Dr. Dewey, would record the profile just about as accurately as the profile photograph, and has the added advantage of more accurate recording of the denture in relation to the profile. I have never used a profileograph, but I have seen it used several times. I believe this instrument would add valuable information to that obtained by mapping a case, especially in those cases where there is an incorrect mesiodistal relation. So much for the preliminary necessities before designing an appliance.

In designing an appliance, there are several basic requirements, all of which must be fulfilled as nearly as possible, but sometimes one does conflict with another. The first and most important requirement is that it shall exert only very mild force at all times, even immediately after adjustment. Simplicity is a most desirable feature. It should allow the teeth as much freedom as possible and interfere as little as possible with natural growth. It should require a minimum number of adjustments. It should be easy to keep clean. All of these requirements cannot be fulfilled by any single type of appliance that will be suitable for every type of case. In my practice I employ several types of appliances. The three forces which appeal to me as being most acceptable are those produced by light auxiliary springs, Stanton sliding devices, and Arnold coil springs. Of these each has its advantages, and each has its place. They all have in common the first requirement of an orthodontic force, constant gentle pressure. As I have said before, I use all types of appliances, but I try to employ one of these three whenever I feel it will be efficient. In discussing the application of these forces, I shall have more to say about the sliding device than the other two, not because I use it more, but because so much has already been written about the other two, the lingual arch with auxiliary springs in particular. As for the coil springs, Dr. Arnold has given us numerous uses for them, and I am finding more and more uses as I become more familiar with them. In my opinion, the fine gauge coil spring, in those places in which it can be applied, is the nearest approach we have to the ideal orthodontic force. In my original outline for this paper, I had planned to describe how I treat the various types of individual cases, but perhaps it would be better to describe wherein my technic differs somewhat from ordinary or, I might say, standardized procedures. I shall not do this with the idea of advancing ideas which are supposed to be improvements, or with the idea that any one should adopt them. They have merely worked out well in my hands. Some one else might tackle the same type cases with entirely different appliances and get just as good or better results.

I have already said that I do not feel it is at all necessary to map deciduous cases, but in these cases before appliances are placed it is necessary to be sure that there is no possibility of the malocclusion correcting itself by development without orthodontic aid. This is a big problem. My plan of procedure is to

see the children as young as possible and to take impressions, and then watch the case as long as I can to see what natural development, if any, is taking place. Of course treatment of deciduous dentures cannot be delayed too long, as nothing much can be accomplished after the roots of the deciduous molars begin to be absorbed. But if I have watched a child for two years and no natural expansion has occurred and the mandibular incisors are erupting in a crowded condition, I feel that I am justified in placing expanding appliances. Of course, if the arch at five years is so underdeveloped that even the deciduous incisors are overlapping, I see no reason why treatment should not be started immediately.

There are two types of appliances which I have used in the treatment of these cases, depending on whether the mesiodistal relations are correct or not. I shall first describe the appliance used when the mesiodistal and buccolingual relations of the deciduous molars are correct, but the arches need expansion. For this type of case, I think the Stanton sliding device is ideal. (Fig. 1.) It requires very little attention, there is practically nothing to get out of order, and if it is properly made, the buccolingual relations are as good at the completion of the expansion as they were at the start. Most important of all, the

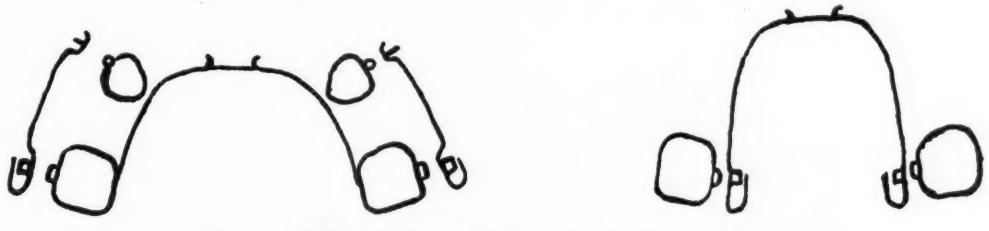


Fig. 1.—Sliding device appliances for deciduous denture.

amount of force used for the expansion of the entire arch is probably not over two or three ounces. After the expansion has been completed, the appliance can be used as a retaining device without alteration, and without fear of displacement. This appliance is made as follows: The sliding device itself can be purchased ready-made, or it can be made in the following manner. A round tube 0.5 mm. long with a 14 gauge lumen is placed on a piece of 15 gauge half round wire (platinum gold alloy) about 20 mm. long. The end of the wire is allowed to extend about one quarter of a millimeter through the tube. On this slight extension is placed a very tiny piece of 22 K. solder, and the tube is soldered to the wire. Using a small amount of solder prevents any solder from running down the walls of the tube. This slight extension is filed flush to the tube after the soldering operation. This operation is then repeated and a duplicate made. The two pieces can then be placed together, the half round wire of one piece sliding through the open portion of the round tube on the other piece. The hooks for the elastics are not soldered to the tubes until the whole appliance is completed. In applying this device to a maxillary deciduous arch, for instance, the canines and second deciduous molars are banded. The sliding device is ordinarily placed across the palate, a little in front of the canines, making sure that it does not interfere with the mandibular anterior teeth. The tubes are separated equal to the amount of expansion desired, and

the half round wires are bent around to the general curvature of the arch. A piece of 18 gauge wire is then flattened slightly with a hammer and bent to the same curvature as the half round wire, and extending back to the second deciduous molar. This piece of wire is held in place against the half round wire by means of very fine iron binding wire; the sliding device is closed completely to eliminate the possibility of soldering it fixed, and the two pieces of wire just mentioned are soldered with 18 K. solder. The same thing is repeated on the other side of the arch, and we then have what resembles a lingual arch in form, but containing a sliding device. This arch is then soldered to the bands on the second deciduous molars. Half round vertical tubes are soldered to the buccal surfaces of these bands, and 20 gauge round tubes are soldered to the buccal surfaces of the canine bands. Removable yokes are then made between these tubes on each side. Small hooks are soldered on the round tubes of the slider with 14 K. solder so as not to fuse the 22 K. solder with which the tubes were fastened to the half round wires.

In making this type of appliance for the mandibular arch it is generally made removable. Ordinarily, the second deciduous molars are banded and

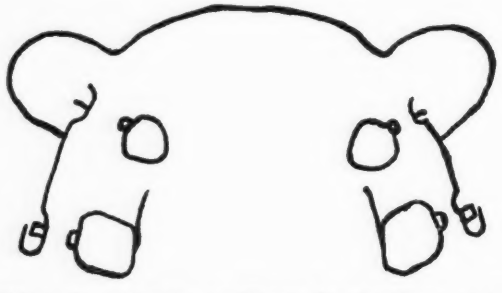


Fig. 2.—Modified pin and tube appliance for deciduous maxillary arch.

half round tubes soldered on the lingual surfaces. The sliding device is adapted to the lingual surface of the anterior teeth as described for the maxillary arch, flattened 18 gauge wires soldered to it, and then half round pins soldered to these wires just as if it were a plain lingual arch. The object of having the mandibular device removable is that light auxiliary springs can be added to it after the expansion has been accomplished.

If the case is one of distoclusion, the appliance described above is used on the mandibular arch with intermaxillary hooks on the bands. On the maxillary arch the second deciduous molars and canines are banded and a light buccal arch, or it might be called a modified pin and tube appliance, is made in the following manner. Vertical half round tubes are soldered on the buccal surfaces of the molars and 20 gauge round tubes on the buccal surfaces of the canine bands. Individual yokes of 19 gauge wire are made on each side joining these teeth. These yokes end in intermaxillary hooks, just in front of the pins on the canines. This wire is heavy, as it is not used in the adjustment of the appliance. About 3 mm. distal to the pin on the canine a 21 gauge wire is soldered to one of the yokes, perpendicular to it. This is bent in the form of a loop over the deciduous canine and comes down again to the permanent lateral incisor if that tooth is erupted. It is then bent at right angles so as to cross

the incisors just below the gingiva to the distal surface of the opposite lateral incisor, when it is bent up and another loop over the canine similar to the one on the other side is made. The free end is then soldered to the 19 gauge yoke. With this very simple appliance (Fig. 2) a variety of movements can be accomplished. The whole arch can be expanded, or it can be expanded only in the canine region or partly in the molar region and more in the canine region. By opening both loops the arch can be kept clear of the anterior teeth, and intermaxillary force can be applied to the posterior teeth. In a case in which the mesiodistal relation is incorrect on one side only, by opening the loop on that side intermaxillary force can be applied to the posterior teeth of that side only. By closing the loops the anterior teeth can be retracted if they are in labioversion. The fact that the light section of 21 gauge wire in which the adjustments are made is attached distal to the canine, allows more freedom of adjustment and produces less strain on the individual teeth if we wish greater expansion in the canine region than in the molar region.

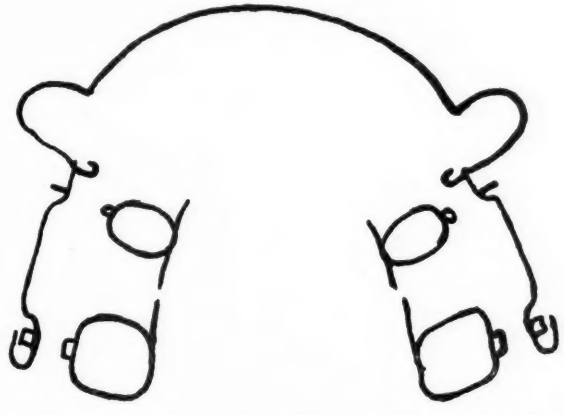


Fig. 3.—Four band, pin and tube appliance for maxillary arch with permanent teeth.

A somewhat similar type of appliance may be used on the permanent teeth, but instead of banding the canines, more often the first premolars are banded. This makes it unnecessary to attach a front section as was done in the previous description. The whole arch wire can be made of one piece of 20 gauge wire, with loops running up over the canines, and the intermaxillary hooks on the arch wire just in front of the pins on the premolar. (Fig. 3.) Of course the same movements can be accomplished as have just been described, and incidentally the molars can be rotated at the same time. It is especially adaptable to a case of unilateral incorrect mesiodistal relation. One must be rather careful in the adjustment of this appliance. After the posterior teeth have been moved into their correct relation, it is often necessary to retract the incisors. The adjustment for the retraction of these teeth is easily and accurately made in the following manner. Some impression plaster is mixed with hot water and salt, and the arch is placed just far enough into this plaster to engage just the four pins and the anterior part of the arch. When the plaster has set, it is trimmed away from the anterior part of the arch so that this part of the arch stands about one millimeter away from the plaster. The arch is then

pressed in until it touches this plaster. It is made passive in this new position by heating. Thus we know definitely just how much pressure is on the anterior teeth, and we also know that the relation of the pins for the posterior teeth have not been changed in the slightest. I feel that this method of adjustment has a decided advantage over any hand bending as it eliminates all unnecessary strain or torsion on the posterior teeth.

When the entire arch needs expansion, it can sometimes be accomplished by sliding devices, the construction of which has already be described. These devices are more often used on the mandibular arch than the maxillary, although they are sometimes soldered to maxillary first premolar bands. Another use of the sliding device is to produce expansion in the canine and premolar region and a small amount or no expansion in the molar region, as the case indicates. (Fig. 4.) This is done in the following manner. Seventeen gauge round tubes are soldered to the lingual surfaces of the molar bands. Lingual arches containing sliding devices with provision for the necessary amount of expansion in the premolar region are placed. As the elastics on the sliding device produce expansion, the molars are held to their original width by bending the lingual arch where it turns in the canine region

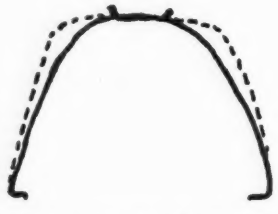


Fig. 4.—Sliding device for expansion in canine and premolar region.

so as to make the arch slightly narrower at the pins that go into the round tubes on the molars. This could not be done if half round tubes were used. It might seem as if there would be temporarily some strain on the molars, even though round tubes are used, but actually there seems to be very little strain on these teeth resulting from a very small amount of play in the sliding device. The expansion in any part of the arch can be controlled very well. The anterior teeth can be rounded out at the same time with this same appliance by the addition of auxiliary springs.

This brings us to a discussion of auxiliary springs. Dr. Mershon and others have described in such fine detail the construction and manipulation of a lingual arch with auxiliary springs that I shall not attempt it here. Rather shall I describe a slight variation in my procedure. Whenever a fine technic has been worked out, some one always comes along with a modification which is, as often as not, not as good as the original. As I claim no originality for this modification, I hope it will not be regarded as an attempt to claim improvement over a well-established technic. We have all had springs become detached from the main arch. I often wonder what becomes of those springs. Sometimes the patient does not know that anything has come off. For this reason I feel that the wrapped spring should be used wherever possible. This is made by soldering the 24 gauge wire on the top of the base wire and wrapping the

wire 1½ times around the base wire before bending it into its desired direction. (Fig. 5.) This attachment is a little more bulky than the regulation soldered joint, but it protects the joint from breaking and incidentally adds greatly to the resiliency of the spring. If the soldered joint should break, the spring would still be loosely attached to the arch wire by means of the wrapped portion, and therefore the spring could not be swallowed.

While on this subject, I should like to describe another method of lessening the possibility of breaking and adding resiliency in attaching springs to high labial arch wires. If a spring is desired from a high labial wire to exert pressure on an incisor in labioversion, a small ¾ ring of 25 gauge wire is soldered to the high labial arch in the same position as the spring would ordinarily be soldered. The spring is then run through this tiny loop and then

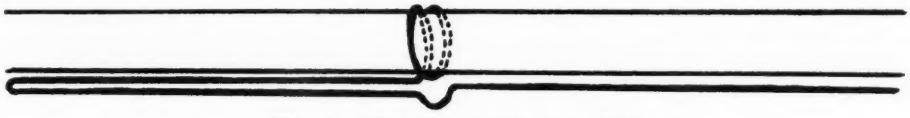


Fig. 5.—Wrapped auxiliary spring.

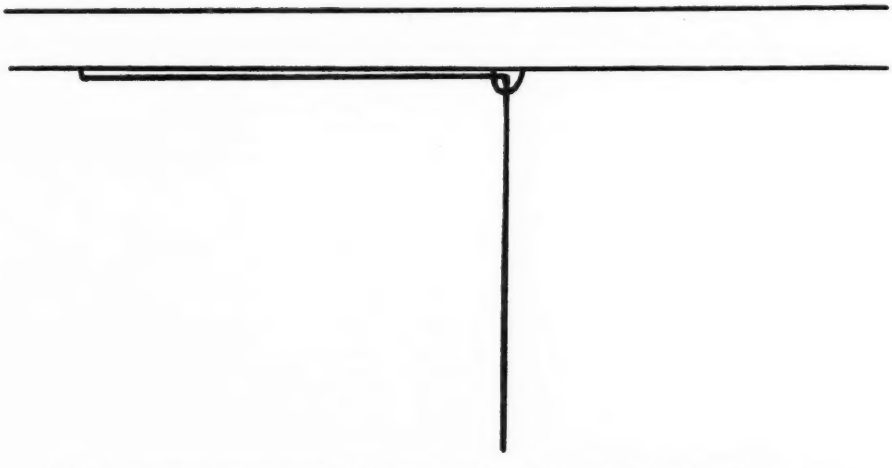


Fig. 6.—Spring from high labial arch going through loop soldered to arch.

bent directly under, and parallel to the labial arch, and is soldered to the arch several millimeters away from the loop. (Fig. 6.) Thus we double the length of the spring, add to its stability, and decrease the strain on the soldered joint. This same type of attachment can be used where one wishes to ligate for rotation. Of course, instead of having the spring bent down to the incisal edge of the tooth as it was in the previous instance, it ends in a loop opposite the hook on the banded tooth to be rotated.

Another point in my mechanical technic differing from that used ordinarily is a means of holding a vulcanite plate in place when such a plate is used for opening the bite. I do not use many such plates, but when one seems indicated, it has always seemed to me incorrect to keep it in by any form of clasp or attachment which crosses the occlusion. Instead, I prefer to place round bumps of solder on the lingual surfaces of the molar bands. The vul-

canite plate then snaps under these bumps and is held firmly in position. When attached in this manner, all the teeth are free, not even the molars are bound in any way.

In concluding this article, may I repeat that the mechanical phase of orthodontia will be of extreme importance as long as our patients have to wear appliances for the correction of malocclusion. All improvements in appliance design will be decided steps forward for our patients' comfort and our own peace of mind.

THE CRISIS IN ORTHODONTIA*

Part I

3. Critical Review of the Publications on Orthodontia by B. Gottlieb, B. Orban, A. M. Schwarz, and J. A. Marshall†

Albin Oppenheim, Vienna, Austria

(Continued from page 247, March)

In addition to the observations of the Angle School, statements of other unprejudiced observers, nonadherers of Angle, who agree entirely in this respect with the Angle School and who have tried "jumping" again and again only to cast it finally aside, are found in the literature. Thus, for instance, Korkhaus writes (Moderne Orthodontische Therapie, 1932, p. 175): "The 'jumping the bite,' introduced by Kingsley, would be a very agreeable method of treatment because of the immediate cosmetic success if one could only rely upon a permanent result. Our few attempts to push the mandible forward forcibly (hinge-joint, Herbst) have always failed even if undertaken in young patients. That others had the same experience has often enough been stated (Case, Dewey, Lockett). The strange part of the matter is that as yet the proofs for the permanency of the results are still lacking in the literature. . . . It seems to me fairly certain that in spite of great efforts a large percentage of these cases relapse."

We read in the textbook of Kantorowicz (Klinische Zahnheilkunde, 1924, p. 731): "By the jumping method we can achieve a perplexing momentary success. . . . I am sceptical as to the permanency of the results once the growth of the jaw is completed. . . ."

H. C. Visick states (Internat. J. Orth. **16**: 1287, 1930): "Plates with inclined planes to 'jump the bite' are a failure in every case I have seen."

Identical experiences were had by the Orthodontic Department of the Dental Institute of the University of Vienna, where nearly 100 cases were treated, resulting in ultimate failure.‡ Similar observations were made by Milo Hellman among his own cases, as well as among those of the late James I. Lane.

From Lundström (Ztschr. f. Zahnärztl. Orthopädie, 1911, p. 151) I quote the experience of Talbot: "I never was successful in performing this operation [jumping] although I tried it often in many cases, and I do not believe that its performance is possible . . ." (p. 153): "Talbot felt sure that his operation could not be accomplished, although Kingsley asserted to have

*From the Department of Orthodontia of the Dental Institute of the University of Vienna.

†Translated in abbreviated form from *Ztschr. f. Stomat.* Supplement to No. 22, November, 1933, published by Urban & Schwarzenberg, Vienna and Berlin.

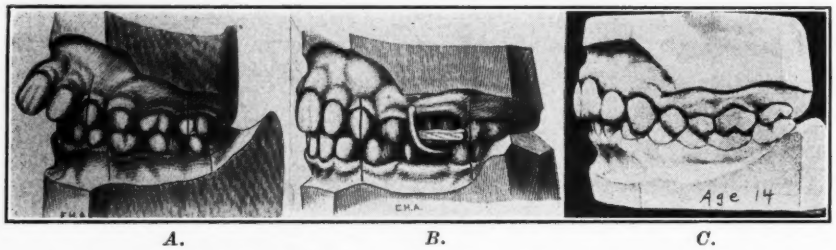
‡Among all these cases a good result of the active treatment was obtained in 3 cases, which were treated with inclined planes; however, these patients still wear the inclined planes, and therefore, it is not yet possible to pass judgment on the permanency of the results.

succeeded several times. To clear up the situation Talbot once had this original idea: To set up a prize of 100 dollars for Kingsley or any one who could prove to have performed such an operation with *permanent result.*"

To gain a general view of the present opinion of the leaders of our profession I sent out 27 inquiries. From 4 men I received no answer; one answer was evasive with an undecided point of view; 6 answers were an affirmation of successful employment of the method, and 16 men answered absolutely in the negative.

The affirmation of success thus appears six times in written form; there exists, however, up to now, no tangible proofs whatever of the successes of these six men, except for one case of Northcroft's.

As far as I could ascertain, Northcroft's case is the only one successfully treated by the jumping method and published in dental literature (Dental Record, 1930, p. 259). Northcroft was kind enough to place the models of this case at my disposal; even after many years, it is really an unquestionable success. But one swallow does not make a summer. It may be that this case was one of the not very rare cases of mandibular retrusion in which,



A. *B.* *C.*

Fig. 15.—Angle's Figs. 615, 618, and 622. For explanation, see text.

after the removal of the obstacle (widening of the maxillary arch), the mandible slipped forward by itself.

Very interesting are the answers of the sixteen orthodontic authorities reporting their failures. The answer is nearly always the same: "I have never seen a permanent result."* As most weighty, may be considered the answer of R. Ottolengui, for he was closely associated with Kingsley and has used the jumping method for years. With the permission of Dr. Ottolengui an extract from this answer may be reproduced: ". . . I must confess to you that the operation of jumping the bite, so called, was one in which I lost confidence. I had many cases which appeared to be successful, and subsequently I had other cases which made me believe that the results, even when apparently good, would be only temporary. The mobility of the mandible led me at one time to believe that Dr. Norman W. Kingsley was correct and that with suitable plates the mandible could be compelled to occlude in its right position and that eventually this habit could be formed . . ."

To refute the statement "that by the jumping method permanent results are achieved," I shall show three cases; two of these are to be found in the literature, the third is from my own latest observations.

*J. V. Mershon (letter of Nov. 1, 1933): ". . . like you I have never seen or heard of any one's finding anything but failure from that type of procedure . . ."

In Fig. 15 we see a case of Dr. Angle's (7th edition, which corresponds to his p. 499):

"Another plan of treatment to be considered is that introduced by Dr. Norman W. Kingsley, orthodontia's greatest genius. . . . The Kingsley method consists in having the patient voluntarily move the lower jaw forward the requisite distance to establish normal mesiodistal relations of the opposing jaws, or 'jumping the bite,' as he termed it, and then retaining the teeth in this position. . . .

"The greatest difficulty to overcome in following this plan of treatment is to keep the lower jaw forward and the teeth functioning in their normal relations long enough for the change in all of the tissues involved to become permanent. For this purpose various forms of plates were resorted to, and as most of them were under the control of the patient and annoying to him, he frequently temporarily omitted to wear them, and this often brought discouragement and caused a large percentage of failures. In fact the difficulties to be overcome in retention were so great that even the possibilities of success by this method were doubted by many, as strenuous controversies in the literature bear witness. Yet that it could be and was accomplished there is no longer any doubt. The author succeeded in the treatment of several cases, after this method, but only after devising the plan of retention shown in Fig. 512 [Fig. 15*B* of this paper] and then only after the persistent use of the device for usually about two years.

"The history of one of these cases, here described, is of unusual interest. The occlusion at the beginnnig of treatment is shown in Fig. 509 [Fig. 15*A* of this paper]. . . . The corrected occlusion two years after the beginning of treatment is shown in Fig. 512 [Fig. 15*B* of this paper]. The author was greatly gratified with his success in this case and believed it to be a most desirable plan of treatment, as with it the full complement of teeth could be preserved and normal occlusion established, and it seemed the normal facial lines could also be established.

"About three years after the discontinuance of retention, on examining the facial lines and the teeth of the patient, an important discovery was made, namely, that although the normal relations had been maintained between the teeth, the mandible had slowly drifted back to probably very nearly its former relations with the skull, but in so doing the crowns of the teeth of the upper arch had been dragged distally to a noticeable degree, while the crowns of the teeth of the lower arch had been tipped forward. . . .

"Fig. 516 [Fig. 15*C* of this paper] shows a model of the case taken at the age of fourteen years which clearly shows the changes incident to the recurrent movement of the jaw. The position of the chin in its relation to the rest of the face also confirms the fact that the mandible has slipped back.

"This discovery in this case led to the examination of other cases similarly treated, with the same results, so it seems probable that the plan of treatment first described (the use of intermaxillary elastics) should be regarded as the one most practicable and desirable for this class of cases."

(To be continued)

TREATMENT OF BILATERAL DISTOCLUSION*

C. J. Vosmik, D.D.S., Cleveland, Ohio

Case 1.—*History.*—Boy, aged nine years, weight 60 pounds, height 4 feet and 5 inches. The facial forms of both the mother and the father were normal. The child weighed seven pounds at birth. The deciduous teeth had erupted normally. Childhood diseases had consisted of whooping cough at one year, chickenpox at five years, and measles at seven and a half years. Adenoids and tonsils had been removed at six years. The child was a mouth-breather. The facial form was abnormal. He had no sucking or pillowing habits, and his general health was normal at the time orthodontic treatment was begun.

Oral examination revealed the teeth and surrounding tissues in a healthy condition. The mandibular deciduous canines had been lost prematurely.

Attributed Etiology.—The habit of mouth-breathing may be considered the etiologic factor causing the malocclusion.

Diagnosis.—Impressions were taken in modeling compound, from which casts of the denture were constructed. Fig. 1 shows views of the casts made at the beginning of treatment November, 1925. The case was classified as a bilateral distoclusion with a linguoclusion of the mandibular incisors.

Treatment.—The teeth and dental arches were restored to a normal functional and anatomic relationship by the following plan of treatment: *first,* lateral expansion of the maxillary and mandibular dental arches; *second,* labial movement of the mandibular incisors and retraction of the maxillary incisors; *third,* a change in the relationship of the maxillary and mandibular arches.

Molar bands carrying half round lingual tubes and 0.040 in. buccal tubes were constructed for the four first permanent molars. Removable lingual arch wires carrying compound auxiliary springs in the region of the deciduous canines and molars were placed in the maxillary and mandibular arches. Labial wires constructed of 0.040 in. round wire carrying loops of 0.025 in. wire just anterior to the buccal tubes were also placed in the maxillary and mandibular arches. The maxillary labial wire also carried hooks for intermaxillary elastics. In the course of treatment, vertical extensions of 0.025 in. wire were soldered to the maxillary labial wire to produce the rotation of the maxillary incisors. Intermaxillary elastics were inserted at the time treatment was begun. The mandibular incisors were brought labially by means of the labial arch and wire ligatures. The force exerted by the intermaxillary elastics causing the maxillary labial wire to move distally through the buccal tubes retracted the maxillary incisors.

Results Achieved.—The patient presented for treatment November 27, 1925. In September, 1927, after about two years of treatment the appliances were removed, and soldered lingual retaining wires were inserted in both arches. The retaining wires were removed in July, 1929.

*Presented to the American Board of Orthodontia.

Fig. 2 shows views of casts and Fig. 3 shows photographs of patient, September, 1931.

Prognosis.—The prognosis is favorable that a normal functional and anatomic relationship will be maintained.

CASE 2.—*History.*—Girl, aged twenty years, weight 117 pounds, height 5 feet and 7 inches. The facial form of the father was normal. The facial form

Fig. 1.

Fig. 2.

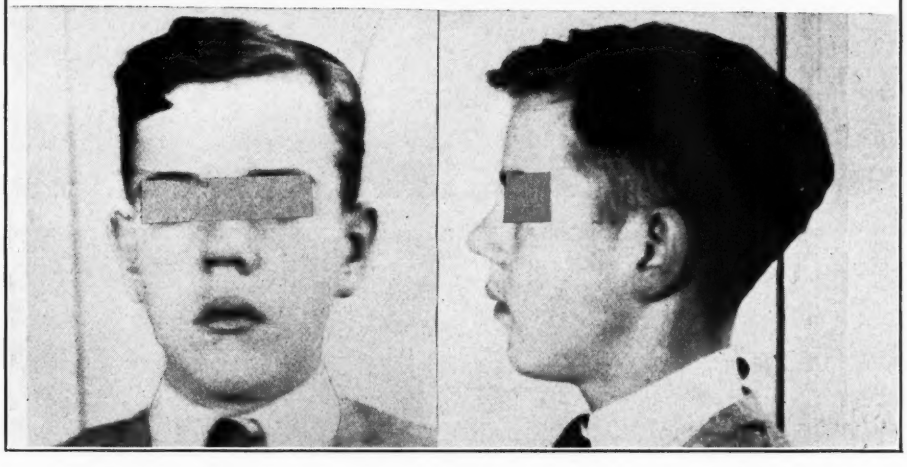


Fig. 3.

of the mother was abnormal. Child had been breast fed during infancy; she began walking at fourteen months. The first deciduous tooth erupted at seven months; the first permanent tooth erupted at six years. The childhood diseases consisted of whooping cough at four years and measles at seven and a half years. The tonsils and adenoids had been removed at nine years. There was no history of sucking habits or mouth-breathing. The general health of the patient was normal at the time orthodontic treatment was begun.

Oral examination revealed the teeth and surrounding tissues in a healthy

condition. Radiographic examination revealed a possible impaction of both mandibular third molars.

Fig. 4.

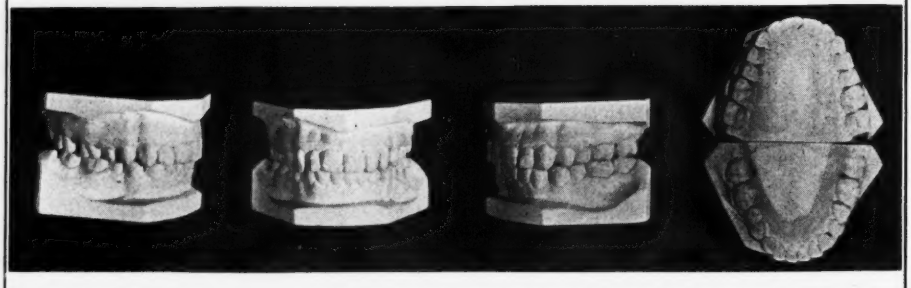


Fig. 5.

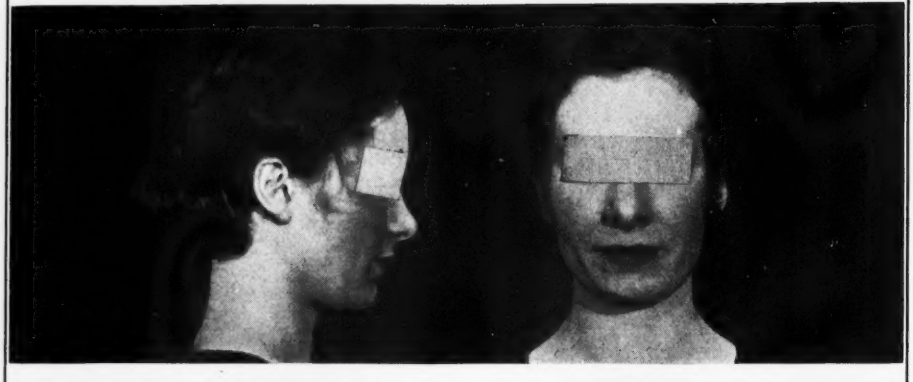


Fig. 6.

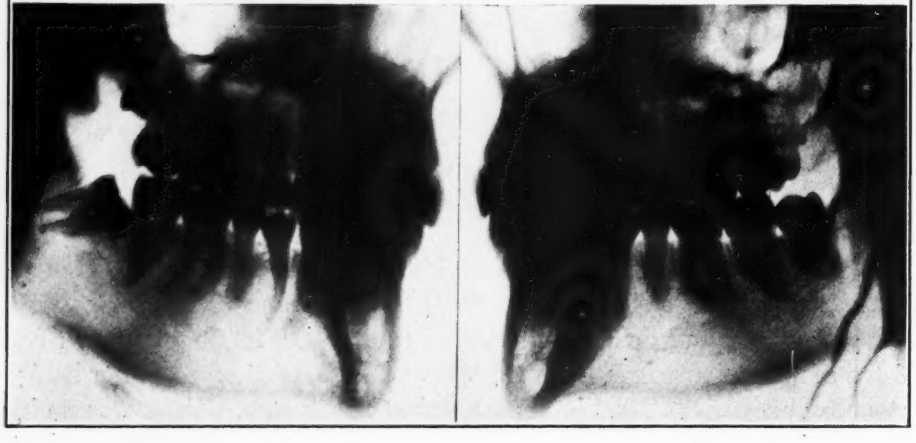


Fig. 7.

Attributed Etiology.—Heredity and a possible disturbance in growth during childhood may be considered the etiologic factors causing malocclusion.

Diagnosis.—Impressions were taken in modeling compound, from which casts of the denture were constructed. Fig. 4 shows views of the casts made at the beginning of treatment, July, 1927. The case was classified as a bilateral distoclusion.

Treatment.—The teeth and dental arches were restored to a normal functional and anatomic relationship by the following plan of treatment: *first,* lateral expansion of the maxillary and mandibular dental arches; *second,* lingual inclination of the maxillary incisors; *third,* a change in the relationship of the maxillary and mandibular dental arches.

Molar bands carrying half round lingual tubes and 0.040 in. buccal tubes were constructed for the four first molars. Removable lingual wires carrying compound auxiliary springs in the region of the canines and premolars were placed in the maxillary and mandibular dental arches. Labial wires constructed of 0.040 in. round wire carrying loops of 0.025 in. wire just anterior to the buccal tubes were also placed in the maxillary and mandibular dental arches. The maxillary labial wire also carried hooks for intermaxillary elastics and vertical extensions to produce lingual tipping of the maxillary incisors. The mandibular incisors and canines were aligned by means of the labial arch and wire ligatures. Intermaxillary elastics were used from the time treatment was begun. The force exerted by the intermaxillary elastics causing the maxillary labial wire to move distally through the buccal tubes effected the lingual tipping of the maxillary incisors. After proper mesiodistal relationship of the maxillary and mandibular dental arches had been established, a wire bite plane was constructed on the lingual arch to reduce the overbite.

Results Achieved.—The patient presented for treatment July 25, 1927. In April, 1929, the appliances were removed, and a soldered lingual retaining wire was placed in the mandibular dental arch while a Hawley retainer was placed in the maxillary dental arch to be worn at night only. The retainers were removed in September, 1930.

Fig. 5 shows views of casts made November, 1931.

Fig. 6 shows views of patient made February, 1932.

Fig. 7 shows extraoral radiographs made November, 1931.

Prognosis.—The prognosis is favorable that a normal functional and anatomic relationship will be maintained.

Case 3.—*History.*—Boy, aged ten and a half years, weight 94 pounds, height 4 feet and 11 inches. The facial form of the mother was normal, facial form of the father abnormal. The father stated that distoclusion was prevalent in his family. The child had been fed on breast and bottle during infancy. The first deciduous tooth erupted at six months; the first permanent tooth erupted at six years. The child began to walk at thirteen months. He was a thumb-sucker. He had suffered a blow on the deciduous maxillary central incisors. The diseases during childhood consisted of intestinal infection at three and a half years and measles at seven years. Tonsils and adenoids had been removed at eight years. The child had a decidedly deflected nasal septum and was a mouth-breather. He suffered recurrent attacks of colds and was easily fatigued.

Oral examination revealed the teeth and surrounding tissues in a healthy condition. Radiographic examination, Fig. 8, showed all structures normal.

Attributed Etiology.—The habits of thumb-sucking and mouth-breathing may be considered the exciting causes, while hereditary tendency may be considered the remote cause producing the malocclusion.

Diagnosis.—Impressions in modeling compound were taken, from which casts of the denture were constructed. Fig. 9 shows casts made at the beginning of treatment. The case was classified as a bilateral distoclusion.

Treatment.—The teeth and dental arches were restored to a normal functional and anatomic relationship by the following plan of treatment: *first,* lateral expansion of the maxillary arch; *second,* removal of interference by the

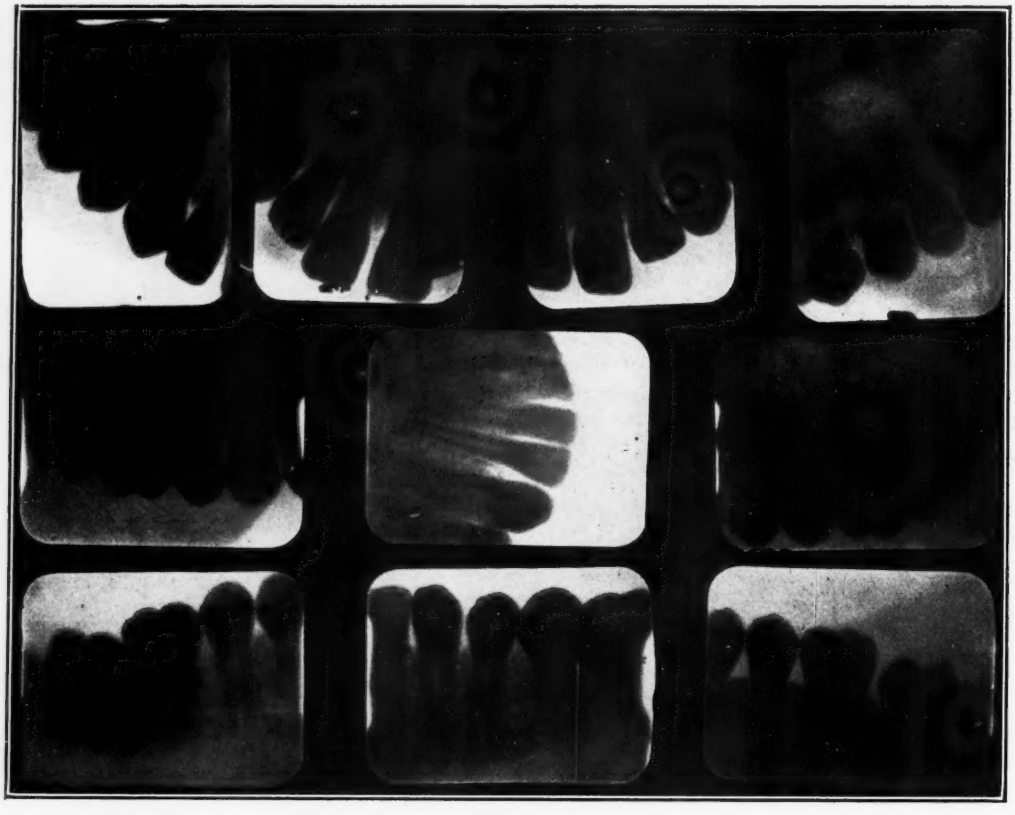


Fig. 8.

alignment of the maxillary incisors; *third,* a change in the relationship of the maxillary and mandibular dental arches.

Molar bands carrying half round lingual tubes and buccal hooks for intermaxillary elastics were placed on the mandibular first molars, and molar bands carrying half round lingual tubes and 0.040 in. buccal tubes were placed on the maxillary first molars. Removable lingual wires were placed in both the maxillary and the mandibular dental arches. The maxillary lingual wire carried compound auxiliary springs in the region of the canines and premolars. The maxillary dental arch also carried an 0.040 in. labial wire with hooks for intermaxillary elastics. The maxillary incisors were aligned by means of the labial wire and wire ligatures. Intermaxillary elastics were used from the time treatment was begun.

Results Achieved.—The patient presented for treatment August 12, 1929. Fourteen months later, October, 1930, the maxillary and mandibular lingual

Fig. 9.

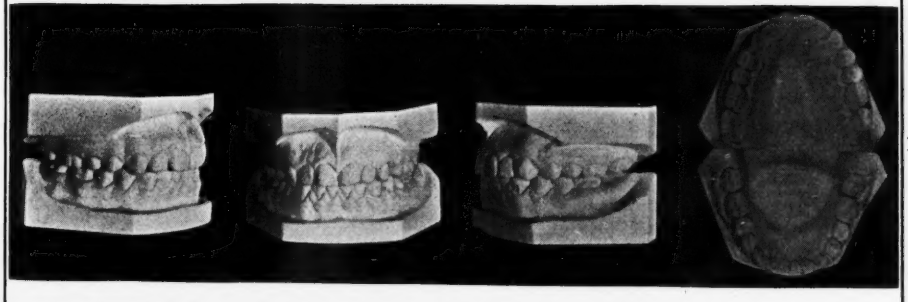


Fig. 10.

Fig. 11.

Fig. 12.

wires were removed. The maxillary labial wire was used to retain the maxillary incisors. The labial wire was removed in May, 1931.

Fig. 10 shows views of casts, Fig. 11 shows photographs of patient, and Fig. 12 shows radiographs, March, 1932.

Prognosis.—The prognosis is favorable that a normal functional and anatomic relationship will be maintained.

CASE 4.—*History.*—Boy, aged thirteen years, weight 73 pounds, and height 4 feet and 6 inches. The mother's health and diet had been normal during pregnancy. The child weighed seven pounds and two ounces at birth. During infancy, he was fed on both breast and bottle. The diseases of childhood consisted of a severe case of whooping cough at one year and measles at five and a half years. The tonsils and adenoids had been removed at eight and a half years. The child was a mouth-breather but had no sucking habits.

Oral examination revealed hypoplasia of the incisors and first permanent molars in both the maxilla and the mandible. Extraoral radiographic examination, Fig. 13, revealed normal development of teeth and alveolar process.

Attributed Etiology.—Mouth-breathing may be considered the exciting cause and a disturbance in growth processes may be considered the remote cause producing the malocclusion.

Diagnosis.—Impressions in modeling compound were taken, from which casts of the denture were constructed. Fig. 14 shows casts made at the beginning of treatment, January, 1928. The case was classified as a bilateral distoclusion.

The teeth and dental arches were restored to a normal functional and anatomic relationship by the following plan of treatment: *first,* lateral expansion of both the maxillary and mandibular arches; *second,* removal of interference by the alignment of the maxillary incisors; *third,* change in the relationship of the maxillary and mandibular dental arches.

Molar bands carrying half round lingual tubes and 0.040 in. buccal tubes were placed on the four first molars. Bands carrying lingual spurs were placed on the maxillary incisors. Removable lingual wires carrying compound auxiliary springs in the region of the canine and premolars were placed in the maxillary and mandibular dental arches.

Labial wires constructed of 0.040 in. round wire carrying loops of 0.022 in. wire just anterior to the buccal tubes were also placed in the maxillary and mandibular dental arches. The maxillary labial wire also carried hooks for intermaxillary elastics and vertical extensions of 0.025 in. wire to produce lingual tipping of the maxillary incisors. The maxillary and the mandibular incisors were aligned by means of the labial arch and wire ligatures.

Results Achieved.—The patient presented for treatment January 5, 1928. In March, 1930, the appliances were removed, and a soldered lingual retaining wire was placed in the mandibular arch and a Hawley vulcanite retainer was placed in the maxillary arch. Both retaining appliances were removed in February, 1930.

Fig. 15 shows views of casts, Fig. 16 shows photographs of patient, and Fig. 17 shows extraoral radiographs, February, 1932.

Prognosis.—The prognosis is favorable that a normal functional and anatomic relationship will be maintained.

CASE 5.—*History.*—Girl, aged nine years, facial form of father normal. Mother had distoclusion. The facial form of the child was abnormal. The

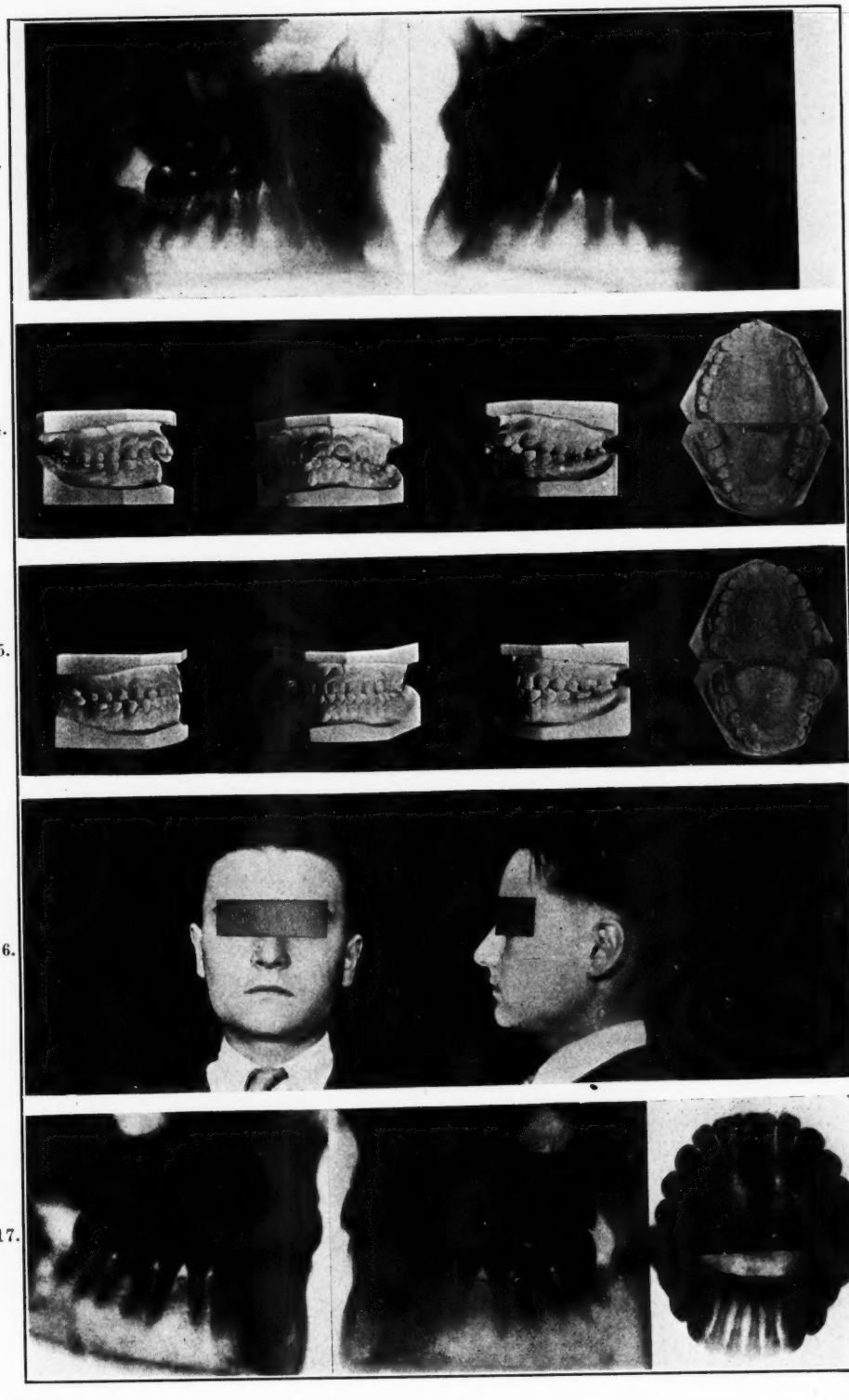


Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

Fig. 17.

Fig. 18.

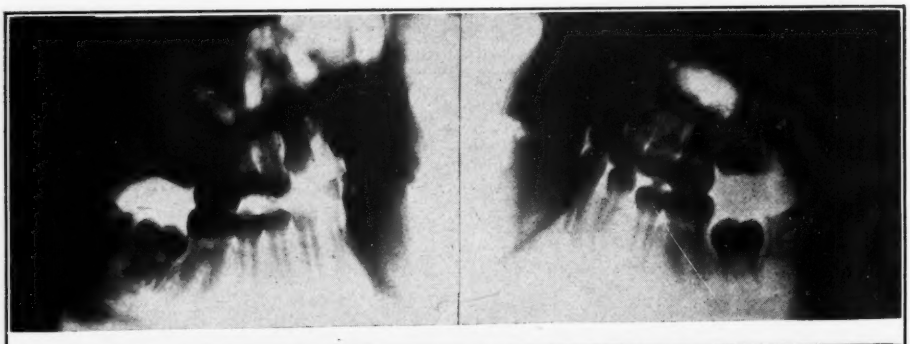


Fig. 19.

Fig. 20.

Fig. 21.

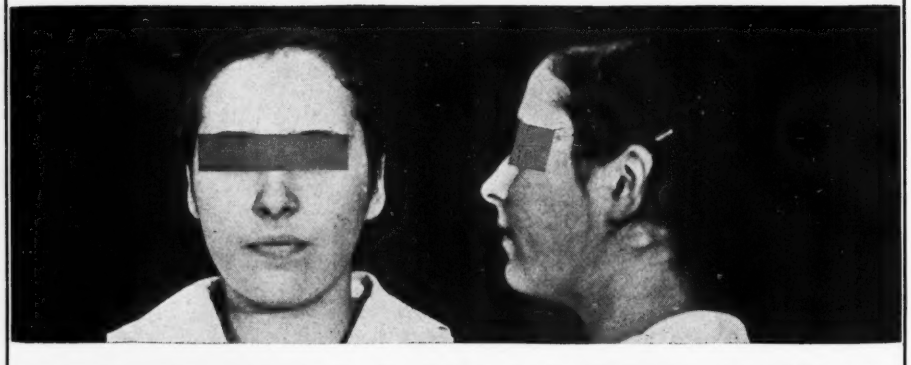
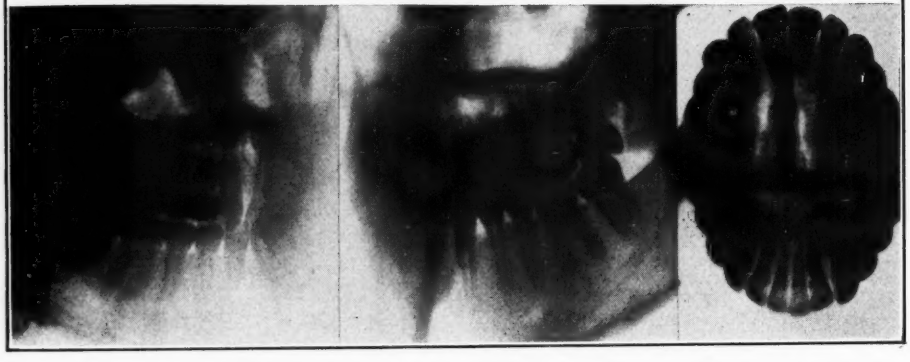


Fig. 22.



deciduous teeth had erupted normally. The child began to walk at thirteen months. The diseases of childhood consisted of measles at six years, whooping cough at seven years, and scarlet fever and pneumonia at eight years. The tonsils and adenoids had been removed at six years. The child was a mouth-breather. She had fallen and fractured the maxillary left central incisor at seven years.

Oral examination revealed pit cavities in both mandibular first permanent molars. Extraoral radiographs revealed that all teeth were present and erupting normally. Fig. 18 shows radiographs taken May, 1926.

Attributed Etiology.—Mouth-breathing and a possible disturbance in growth processes may be considered the etiologic factors causing malocclusion.

Diagnosis.—Impressions were taken in modeling compound, from which casts of the denture were constructed.

Fig. 19 shows views of casts made in May, 1926. The case was classified as a bilateral distoclusion.

Treatment.—The teeth and dental arches were restored to a normal and anatomic relationship by the following plan of treatment: *first,* slight expansion of the maxillary premolars on the right side; *second,* a change in the relationship of the maxillary and mandibular dental arches.

Molar bands carrying half round lingual tubes and 0.040 in. buccal tubes were placed on the maxillary first molars, and molar bands carrying half round lingual tubes and buccal hooks for intermaxillary elastics were placed on the mandibular first molars. The maxillary dental arch carried a removable lingual wire with simple auxiliary spring on the right side, and a labial wire constructed of 0.040 in. round wire with hooks for intermaxillary elastics. The elastics were used from the time treatment was begun. After the maxillary and mandibular dental arches had been placed in their normal mesiodental relationship, a vulcanite bite plane was inserted.

Results Achieved.—The patient presented for treatment May 14, 1926. Because cooperation was poor and teeth responded slowly to pressure, it was necessary to continue the use of appliances until March, 1929. At that time a Hawley vulcanite retainer was inserted in the maxillary dental arch. No retainer was used in mandibular dental arch. The retainer was removed March, 1931.

Fig. 20 shows views of casts made January, 1932.

Fig. 21 shows photographs of patient and Fig. 22 shows extraoral radiographs, January, 1932.

Prognosis.—The prognosis is favorable that a normal functional and anatomic relationship will be maintained.

TREATMENT OF CLASS II, DIVISION 1 MALOCCLUSION*

Case Reports

Leland R. Johnson, D.D.S., M.S.D., Chicago, Ill.

Case 1.—E. S., a girl, aged eleven years and eleven months, presented for treatment June 22, 1929. She was average in height and weight. The mandible was bilaterally distal in its relation to the maxilla. The case was further characterized by arches nearly normal in size, normal palate, protrusion of the maxillary incisors, a supraversion and spacing of the mandibular incisors, and a lack of vertical development in the premolar and molar region. The mandibular left second deciduous molar was in the process of "submerging" and was extracted. The space for the mandibular left second premolar was insufficient. The mandibular incisors occluded with the maxillary incisors at the gingivae of the maxillary incisors.

Tonsils and adenoids had been removed at five years of age, and the patient was a normal breather. There was no history of any habits, although the maxillary right central incisor seemed to show evidence of a lip-biting habit some time in the past. X-ray examination showed all teeth to be present and apparently a normal condition of the bone.

To me the etiology of this case is more or less obscure. Perhaps the patient was a mouth-breather at the time of eruption of the first permanent molars and thus they became locked in their distal relation. The general shape of the maxillary arch and palate seems to discount this theory.

The appliances used in treatment were a maxillary labial arch and a mandibular lingual arch to perfect the arch form, and then a bite plate was worn for four months to produce a vertical development of the molars and premolars. Following this, intermaxillary force was used to correct the jaw relation. This treatment was augmented by muscle exercises for the orbicularis oris, masseter and temporal muscles, and the case was placed on retention January 24, 1931.

The result obtained in this case is entirely satisfactory, and the occlusion is now apparently functioning normally. However, the x-ray examination after completion of treatment showed a slight absorption of the maxillary right lateral incisor and of the mandibular left first molar roots. Very slight movement of the maxillary right lateral incisor occurred during treatment, but the mandibular left molar was moved considerably to open space for the second premolar. The prognosis of this case should be favorable.

Case 2.—R. W., male, thirteen years and eleven months old, presented for treatment October 21, 1927. General health was good, and the boy apparently was of average build and weight. He was a mouth-breather, although the

*Presented to the American Board of Orthodontia.

tonsils and adenoids had been removed at seven years of age. There was evidence of biting and sucking the lower lip. He had sucked his thumb until he was four years of age. He had been struck by an automobile a few years before, and the upper lip had been badly cut. This left a great deal of scar tissue in the upper lip, and the lip was very much underdeveloped and lacked muscle tone. The lower lip was thickened and carried the imprints of the maxillary incisors. The maxillary incisors were in extreme protrusion, and the mandibular incisors had caused their imprint to be left in the soft tissue of the palate where they were striking. The enamel was decalcified on all the incisors resulting from the difficulty of getting a brush between the upper lip and the incisors. Both arches were narrow.

Etiology.—A combination of thumb-sucking and mouth-breathing probably is responsible for this malocclusion. The position of the lips made it a progressive type.

Treatment.—The appliances used were a maxillary labial arch with lingual extensions and a mandibular lingual arch. Force was applied November 28, 1927, and the necessary expansion was gained by February 13, 1928. A bite plate with a plane to depress the mandibular incisors and to create vertical development in the molar and premolar regions was then employed in conjunction with the mandibular lingual arch until September 6, 1928. The maxillary labial arch was again placed in the mouth, and intermaxillary force was employed to tip the maxillary incisors lingually. As soon as they had reached their proper position, the nuts were turned down against the tubes and intermaxillary force was applied to the abnormal side to correct the jaw relation. The maxillary central incisors were brought together by using a figure-of-eight silk ligature. As soon as the teeth reached a position of mechanical advantage, exercise for the masseter and temporal muscles was advised. The elastics were worn until September 3, 1929, when the case was placed on retention. The treatment appliances were used as retainers, and the intermaxillary elastics were gradually discontinued. During treatment, exercises to develop and lengthen the upper lip were given. In June, 1930, the maxillary appliance was removed and a Hawley retainer made. This was worn until June, 1931. Wearing of the Hawley retainer was then gradually discontinued. Final impressions were made November 11, 1931.

X-ray pictures taken April 6, 1932, showed the roots of the teeth to be in good condition, and the character of the investing bone tissue appeared normal.

The result in this case is a great improvement, although from the standpoint of ideal occlusion the case is probably no more than 85 per cent perfect. However, the occlusion is functioning, as is the upper lip which is greatly improved. The prognosis in this case should be favorable. There has been no tendency to relapse at the date of this writing.

Case 3.—T., a young man, aged nineteen years and ten months, presented for treatment October 30, 1928. According to Angle's classification this case may be classified as Class II, Division 1, characterized by a distal relation of the mandibular jaw on the right side. The mandible was slightly narrow and the incisors were in supraversion to a limited degree, while there was a slight infraversion of the mandibular molars and premolars. The constricted maxillary

arch presented an extreme protrusion of the maxillary incisors and a palate that could be considered normal instead of the typical high V-shaped palate, so common in cases of this classification.

A general survey of the patient showed a marked inferiority complex. The facial characteristics consisted of a short, underdeveloped, upper lip and a thickened lower lip which exerted pressure on the lingual surface of the maxillary incisors. The lips could be closed only by extreme effort, and the incisors protruded between the lips. The patient was a normal breather; the tonsils and adenoids had been removed at twelve years of age. The labium frenum was normal, and the median line in the mandible was about two millimeters to the right. Hygienic conditions were excellent. The full mouth x-ray examination showed all third molars absent except the maxillary left. All the other teeth were present and the bone appeared normal.

There was no history of thumb- or finger-sucking and I do not believe mouth-breathing was a factor in this case. The position of the maxillary incisors and the malformation of the alveolar process in the incisor area were probably due to an abnormal pressure of the lower lip associated with a lack of muscular pressure and normal function of the upper lip.

The appliances used in the treatment of this case were a maxillary labial arch with lingual extensions and a mandibular lingual arch with finger springs. After the necessary expansion was obtained, intermaxillary force was employed to tip the maxillary incisors lingually. As soon as they were in position, the nuts were turned down against the tubes, and intermaxillary force was applied on the abnormal side to correct the jaw relation. An exercise for the orbicularis oris muscle was prescribed as soon as the incisors had been tipped lingually. As soon as a position of mechanical advantages was attained, exercise for the masseter and temporal muscles was employed. Intermaxillary elastics were gradually discontinued after the jaw relation was corrected, and the case was placed on retention November 2, 1929, after one year of treatment.

The appliances used during treatment were used as retainers for one year. A Hawley retainer was then constructed for the maxillary arch and was worn at night only until lost two months later. Observation showed no relapse, and the patient was dismissed.

The result achieved in this case is a satisfactory occlusion from the standpoint of esthetics and function. The inferiority complex is greatly reduced, and the patient is greatly benefited. X-ray examination taken two years and five months after treatment showed a slight rounding of the apices of the maxillary central incisors, and pulp stones in the mandibular molars, but otherwise the teeth and investing tissues appeared normal. The prognosis should be favorable, since no change has taken place one year and five months after the retainers were removed and the occlusion is apparently functioning normally.

EVOLUTION OF CHROME ALLOY TECHNIC IN MY PRACTICE

BROOKS BELL, D.D.S., DALLAS, TEXAS

November, 1932, to March, 1933:

Renfert old type band material and wire used with Renfert sheet solder and Renfert flux. Result: Within a week's time soldered joints blackened and came unsoldered; it was impossible to solder on either gold or chrome tubes.

March to May, 1933:

Renfert new type (same as present) band material and wire used with Renfert's wire form solder and Austenal or Crescent flux. Result: Blackening still occurred with joints coming unsoldered within a month; could not solder on tubes.

Hutton solder and Hutton flux were same as above.

Hutton and Rocky Mountain materials were tried, but they required too much polishing because of their dull finish.

May to September, 1933:

Renfert new materials used with Blaurock wire form solder and Austenal flux—surfaces to be soldered were scarified. Result: Bands came unsoldered in three or four months and wires in three to six months; chrome tubes came off, but gold tubes stayed.

September to November, 1933:

Renfert materials used with Blaurock solder and Langley fluxes (four or five different types)—surfaces scarified. Result: Joints stayed soldered ten to twelve weeks but finally blackened and came unsoldered, and chrome tubes would not stick—gold tubes did.

At this time I began perforating through the lapped joints of the bands prior to soldering. Solder was then flowed through these perforations to form gold brads. This lengthened the life of the soldered joint.

November to December, 1933:

Renfert materials used with Renfert solder and Ney flux; surfaces scarified. Result: As high heat was required, wires were detempered; blackened in eight to twelve weeks, but still held without the usual disintegration.

December, 1933, to January, 1934:

Renfert materials used with Rocky Mountain Metal Company's silver wire form solder and Austenal or Langley flux—surfaces scarified. Result: Joints blackened in two to six weeks and came unsoldered. Tubes, gold or chrome, came off.

Presented before the Southwestern Society of Orthodontists, October 15-17, 1934, Abilene, Texas.

January to February, 1934:

Renfert materials used with Rocky Mountain silver wire solder and Rocky Mountain flux—surfaces scarified. Result: Joints blackened and came loose in six to twelve weeks; gold tubes stayed soldered; chrome did not.

February to April, 1934:

Renfert materials used with Rocky Mountain gold wire form solder and Rocky Mountain flux; surfaces scarified at first, later discontinued. Result: Joints on bands discolored, a black precipitate forming and eventually, in four to six months, the joints came apart; soldered joints on wires held permanently although discoloring. Both chrome and gold tubes stayed soldered.

April to present time:

Renfert materials used with welded joints. Result: Bands hold perfectly without any discoloration; wires usually detempered at welded spots; it is difficult to line up tubes properly.

July, 1934, to present time:

Renfert materials used with Jelenko orthoflex low fusing solder and Rocky Mountain flux. Used only for soldering wires and tubes. Result: Discolors slightly but does not disintegrate and come unsoldered.

RÉSUMÉ OF MATERIALS USED

Band Material and Wires: Renfert's old type; Renfert, new type; Hutton's; Rocky Mountain's; Renfert's present type.

Fluxes: Renfert; Crescent; Hutton; Austenal; Langley; Ney; Rocky Mountain.

Solders: Renfert sheet; Renfert wire; Blaurock, first and second types; Rocky Mountain silver wire form; Rocky Mountain gold wire form; Jelenko orthoflex.

PRESENT TECHNIC

All bands are welded.

All tubes, locks and springs, and attachments to tubes and arch wires are soldered with Jelenko orthoflex low fusing solder and Rocky Mountain flux.

Renfert materials are used (Hutton oval tubes).

Result: Bands absolutely do not discolor and disintegrate at joints; all solder joints on wires or bands, though discoloring slightly, hold permanently.

A CASE OF BILATERAL POSTEROCLUSION*

GEORGE R. MOORE, D.D.S., M.S., ANN ARBOR, MICH.

HISTORY.—The patient, a boy aged nine years and eleven months, called for original consultation in April, 1929. The photograph shown in Fig. 1 was taken at that time. His father is an invalid, the victim of accidental injuries, and I have no knowledge of the condition of his teeth, but the mother exhibits a mild bilateral posteroclusion with normal lip function. The boy's maternal cousins, a boy and a girl, both exhibit posteroclusion, of which the boy's is a unilateral. The mother gave a history of normal pregnancy, normal birth, and normal conditions of rest and nutrition during the boy's entire development to this date. He was artificially fed in infancy. He has never been seriously ill; he had only the common children's diseases, measles, chickenpox, and mumps. Tonsils and adenoid tissue were hypertrophied, and he was somewhat subject to recurrent attacks of colds, with the result that he had contracted the habit of mouth-breathing. Radiographs in Fig. 2 show a full complement of teeth.

Attributed Etiology.—With the rather meager data herein set forth it would be very difficult definitely to attribute this case to any one factor. Undoubtedly, there is a hereditary factor inasmuch as so many members of the boy's family present deficiencies of development of the lower face. The mouth-breathing habit possibly contributed in a mild degree particularly to the mild retrusion of the mandibular anterior teeth and protrusion of the maxillary anterior teeth, but it is my belief that the mouth-breathing as well as the deficiency in development of the region are both to be attributed to remote causes.

Diagnosis.—Bilateral posteroclusion of the mandibular arch in relation to the maxillary with retruding mandibular incisors and protruding maxillary incisors complicated by the habit of mouth-breathing and lower lip biting.

Treatment.—By the use of a headgear worn nights with an attachment to cover the lips and keep them in contact, the correction of the mouth-breathing habit was immediately attempted. In addition, the lip biting habit was called to the patient's attention, and he was asked to use routinely, morning and night every day, such an emollient as cold cream, clear lipstick, or liquid petrolatum. The patient and the parent were made to understand clearly that without careful attention to these habits, prognosis of the case was rendered much less favorable. Mechanical treatment of this case was designed to stimulate mandibular development so far as possible by the use of maxillary plain labial wire and mandibular plain lingual wire, attached to first permanent molars by means of horizontal round tubes, closed end on the mandibular and open end on the maxillary. These were used in combination with intermaxillary elastics between

*Presented to the American Board of Orthodontia.

hooks on the maxillary wire in the canine region and hooks on the mesiobuccal surface of the mandibular first permanent molar bands. At first, the spacing of the maxillary anterior teeth was partially corrected by means of intermaxillary stress without stops mesial to the buccal tubes. After this was accomplished, the whole maxillary arch was used as a basis for stimulation of the development of the mandibular arch. Elastics were worn constantly from May 2 to August 19, 1929, nights only from then until January 25, 1930, alternate nights to May 3, 1930, and two nights a week to July 16, 1930, when maxillary molar bands and labial wire were removed. On September 6, mandibular bands and wire were removed, and since that date no orthodontic appliances have been

Fig. 1.

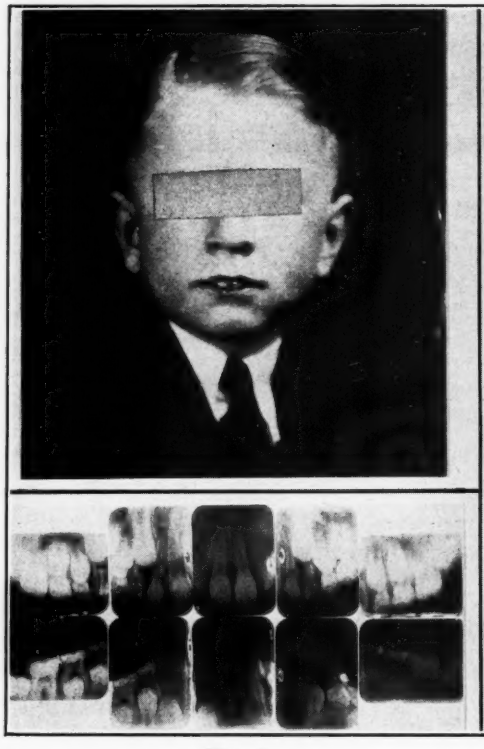


Fig. 2.

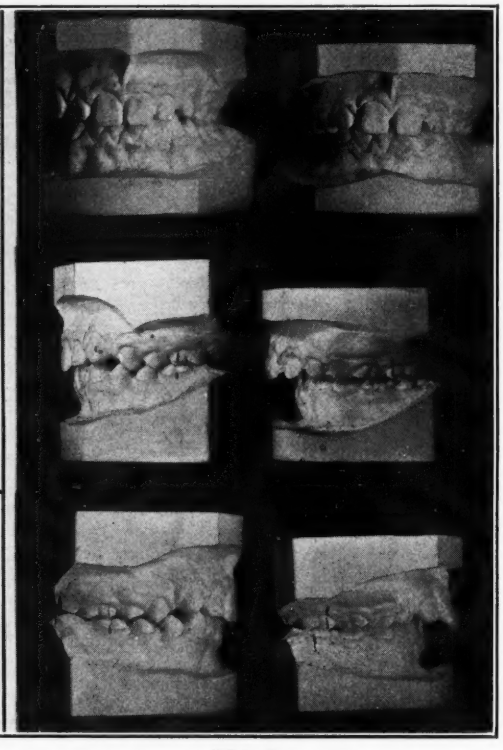


Fig. 3.

used. I am not able to say with what effect, but in January, 1930, I prescribed the use of masseter-temporal exercises according to Rogers.

Fig. 3 shows casts before and after treatment from different angles. The ones on the right show the occlusion in April, 1929, before treatment was begun, and the ones on the left show the occlusion in March, 1932, eighteen months after all appliances were removed. From these figures and the facial and oral photographs in Figs. 4 and 5 taken in April, 1932, it is possible to ascertain what results were achieved by means of the appliances coincidental to normal growth processes. There still remains a relatively deep overbite, as shown in Fig. 4, and the maxillary canines protrude slightly. Between visits, however, the spaces between the maxillary canines and first premolars diminish noticeably. It is not my policy in such cases to interfere by means of appliances. The patient has

been very cooperative in the control of the habits referred to above, with the result shown in the facial photographs (Fig. 5).

Prognosis.—The relatively deep overbite is no more extreme than many others which I am not in the habit of treating at this age. The patient is now thirteen years old, and his second molars are not yet in occlusion. Considerably more vertical development is to be expected if he goes on developing normally

Fig. 4.

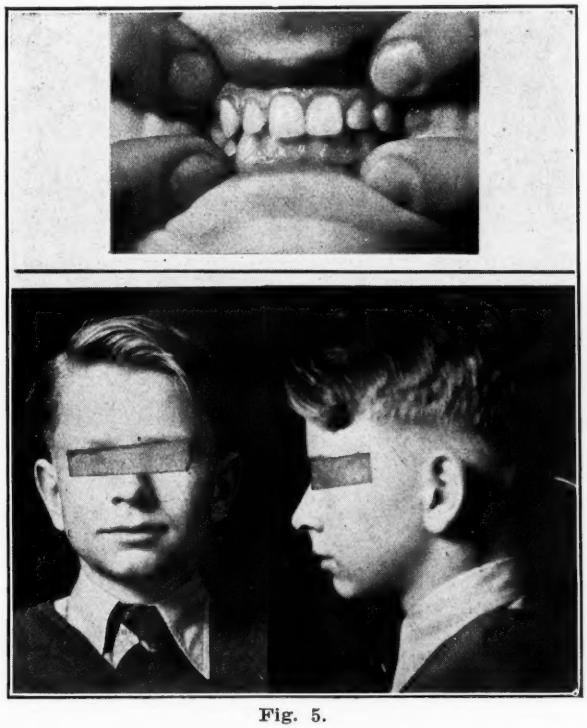


Fig. 5.

from this point, with the result that the depth of the overbite may be noticeably diminished. Intermaxillary elastics had been off two years in July, 1932, and in those two years there had been no tendency of the relationship of the arches to relapse. I therefore consider the prognosis of the case to be very favorable.

Active treatment of this case was continued for fifteen months, and I believe that its object has been realized in that the occlusion seems to exhibit every indication of continuing development normally from this point.

IS A PALATAL BITE PLATE ADVANTAGEOUS IN THE TREATMENT OF ANGLE CLASS II MALOCCLUSIONS?

Dr. F. Skaloud, Prague, Czechoslovakia
Director of the Orthodontic Department of the Dental Clinic of Karl-University, Prague

THE radiographs, Figs. 1, 2, and 3, show the anterior region of the mandibles of three patients. All three patients had Angle's Class II malocclusion; that is, they had distoclusion with a very flat palate and protrusion of the maxillary anterior teeth, an underdeveloped mandible with a considerably exaggerated compensating curve and elongation of the mandibular anterior teeth.

A palatal bite plate was used to improve the occlusion of the premolars and molars before treatment of the distoclusion was started. As a result, the

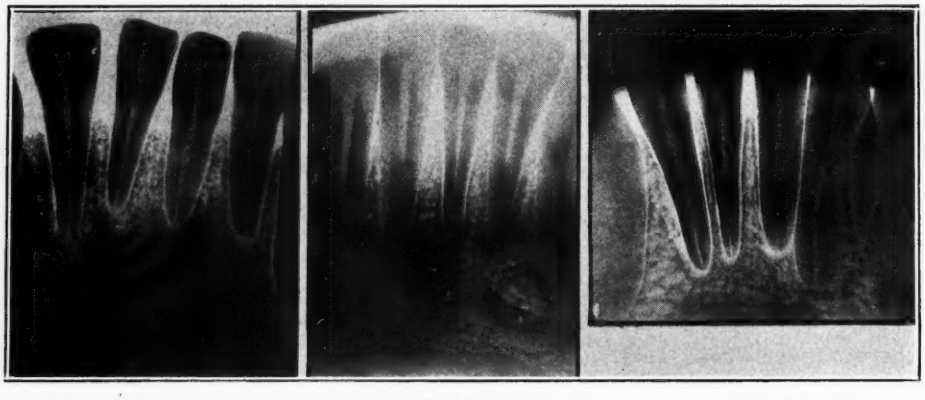


Fig. 1. Fig. 2. Fig. 3.

occlusal plane of the premolars and molars was raised approximately 1 mm., but no more. In our cases the plate was used from four to five months. The patient always removed it before meals and before going to bed.

The illustrations show clearly that the main action of this plate became one of pressure on the mandibular anterior teeth. As a result, the anterior teeth were lowered and considerable resorption was caused, as may be seen in Fig. 1. Already there is evidence of a marked involvement of the supporting tissues.

In our Orthodontic Department of the Dental Clinic, we have discontinued treating such cases with a bite plate.

I believe it my duty to report here our failure with and our complete discard of the bite plate.

Department of Dentistry for Children

CHILD HEALTH DAY

CHARLES A. SWEET,* D.D.S., F.A.C.D., OAKLAND, CALIF.

MAY DAY, for the past few years, has been set aside as Child Health Day in the hope that greater consideration will be given to the health of our children. It is quite fitting and proper that the scientific publications of the dental profession should give space at this time each year to the furtherance of Child Health Day.

The dental profession has made worthy contributions to the advancement of dental health that have had a far-reaching effect upon our general health. Our appreciation to the editors of the dental journals for their cooperation is not amiss at this time, for, without their continued endeavors to disseminate the knowledge that has been gained from these contributions, much less progress would have been made. Through their valuable pages the profession in the remotest town and city is able to keep abreast of the rapid advancement in dentistry at all times. Through these same pages many times inspiration comes for one to delve into some of the problems that will ever be confronting us and to help in their solution.

With the advancement of the focal infection theory dentistry has been even more widely acknowledged as a most important part of all health services. Since the development of this theory more attention has been paid to the health of the oral cavity and to its ramifications into the health of the individual. Some time ago our profession turned its attention to the removal of these foci of infection. They were all too prevalent. Then, we began to give consideration to their prevention in order to eliminate the systemic sequelae arising from these infections of the oral cavity. This problem gave us our first great impulse to care for the child, for here was the source of our trouble.

In more recent years the study of diet has consumed a great deal of attention with many theories advanced to eliminate the inception of dental caries, considered the forerunner of most of the lesions of the oral cavity. In the application of these theories we are again led back to childhood, in fact, even farther back where we are giving serious consideration to the diet of the expectant mother.

For more than half a century investigators have been studying the bacterial flora of the mouth in the hope of solving the problem of dental caries.

*President of the American Society for the Promotion of Dentistry for Children.

Again these studies have dealt mainly with the child, because of the prevalence and the origin of this condition in childhood.

During the past five years studies of the endocrine, or ductless, glands have shown another possibility of solving the problem of dental caries. As yet, little is known of the intimate relationship between these ductless glands and body health, yet we do know that, no matter what the relationship may be, it is of greatest importance in childhood.

In many different centers throughout the United States small groups of dentists have interested themselves in the study and promotion of a greater knowledge of dentistry for children. These groups have contributed largely to the knowledge and skill we now possess to serve children adequately. They have materially assisted in the welfare of their communities by helping to greater health and happiness.

Along with this scientific development and improvement of operative procedures for children's teeth, our dental colleges have responded by including as a part of their curriculum the teaching of dentistry for children. It is true that sufficient emphasis, as yet, has not been given to the subject by our dental educators, but in the past five years there has been a 50 per cent increase in the number of colleges including dentistry for children as a required subject, with more than twice as many teaching hours. Also, our State Boards of Dental Examiners have begun to include in their examinations questions pertaining to dentistry for children.

The May Day of a child's life is happiness, which can only be made possible with health and education. Each one of us can make our contribution to Child Health Day by determining to render not only a better service but a more frequent service to the children in our community and thereby practice the true concept of our profession—prevention. We should be ever mindful that our children should have the full opportunities of good health and education. We should also bring a realization to the parents that it is their responsibility and entirely within their economic reach to bestow the greatest of all blessings on humankind—a strong body and a strong mind.

CHANGES IN DIMENSIONS AND FORM OF THE DENTAL ARCHES WITH AGE*

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THE study of orthodontics has within recent years become increasingly recognized as basically concerned with growth. Naturally of special interest has been the growth of the face in general and of the palate and alveolar arches in particular. The present study contributes data toward the solution of the latter of these problems, namely, upon the growth and development of the alveolar arches. Much has been written on growth of the alveolar arches, but these data have usually been based on observations of single or a very few individuals. To our knowledge, the only contributions which consider reasonably large numbers are those of Franke,[6] Hellman,[7] Lewis and Lehman,[9] and Smyth and Young.[10] A large series is also represented in the present inquiry, but what is hoped may be of special value are the more detailed measurements obtained and the rather extensive consideration of the effects of growth upon form.

MATERIAL

The material comprises measurements upon 546 sets of dentures, representing 300 children between the ages of 1 and 11 years. A number of the children were examined at yearly intervals over a period of from one to four years, thereby accounting for the larger number of dentures than children.

There was no deliberate selection of subjects, who were mainly children of the middle class recommended by friends aware of the project. In the opinion of a nutritionist who had studied the diets of the children, they were, as a group, neither better nor poorer nourished than the general run of children of a similar social sphere. This was also true with respect to health, according to the advice of a pediatrician.

Dentures with both normal and abnormal occlusion are included. Brash[4] (p. 102), interpreting Franke, noted that little or no difference in rate of growth occurred in arches with good or bad occlusion. It may be observed, however, that neither Franke nor Brash has apparently differentiated the *kinds* of malocclusion, wherein differences in growth might occur but be obscured or lost in the consideration of the whole category of malocclusion.

No orthodontic treatment, except space retainers in the deciduous molar region among a number (about 20 per cent), was given any of the children reported upon.

*From the Division of Child Research, College of Dentistry, New York University.
To be presented April 26 before the American Association of Physical Anthropologists, meeting at the Wistar Institute, Philadelphia, Pa.

Some idea of the racial stock from which the children were descendent was obtained by noting the nationality or birthplace of their parents and grandparents. Table I summarizes the situation. It is at once noted that the children are preponderantly of American stock, extending back in the majority of cases at least two generations on each parental side. Children of stocks

TABLE I

ANCESTRY OF CHILDREN ACCORDING TO BIRTHPLACE (IN PERCENTAGE)

	CHILD'S PARENTS* (171)† F. AND M.‡	(51) F.	(46) M.	MOTHER'S PARENTS (229) F. AND M.	(67) F.	(55) M.	FATHER'S PARENTS (229) F. AND M.	(55) F.	(62) M.
United States and Canada	87.1	33.3	56.5	61.5	25.3	54.5	55.4	30.9	48.3
British Isles	5.8	9.8	17.3	14.4	29.8	29.0	10.4	29.0	25.8
Scandinavia and North Europe	2.9	11.7	–	5.2	19.4	5.4	6.9	30.9	16.1
East Europe	4.0	17.6	10.8	13.9	10.4	3.6	17.0	3.6	1.6
Austria Hungary	–	3.9	4.3	3.0	5.9	7.2	4.3	3.6	6.4
Italy	–	15.6	4.3	0.8	4.4	–	4.3	–	1.6
Levant	–	7.8	–	0.4	–	–	1.3	–	–
Mexico and South America	–	–	6.5	0.4	4.4	–	–	1.8	–

*Information was not available for all parents or grandparents.
†Numbers within brackets refer to total numbers from which percentages were obtained.
‡F, father; M, mother.

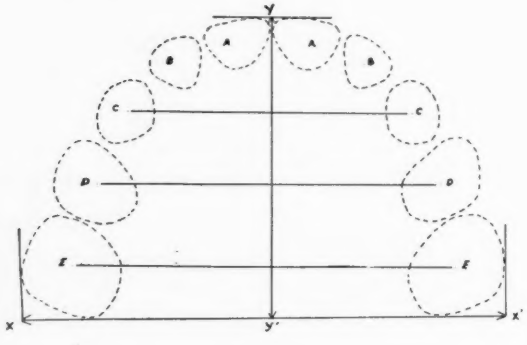

Fig. 1.

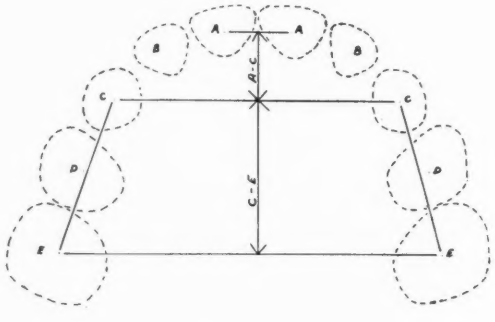

Fig. 2.

Fig. 1.—Landmarks and diameters. *A*, median incisor; *B*, lateral incisor; *C—C*, distance between centroids of canines; *D—D*, distance between centroids of deciduous first molars or first premolars; *E—E*, distance between centroids of deciduous second molars or second premolars; 6—6, distance between centroids of permanent first molars; *W*, maximum width (*X X'*), between buccal aspects at gum line of deciduous second molars; *L*, length (Y - Y') from most anterior curvature made by both central incisors at the gum line (which is practically equivalent to the alveolar point), along middle of arch to a line crossing immediately behind the E - E teeth.

Fig. 2.—Landmarks and diameters. A - C, anterior length, from bisected line between centroids of A - A, to middle of line between centroids of C - C; C - E, posterior length, from bisected line between centroids of C - C, to middle of line between centroids of E - E.

which might conceivably be strikingly divergent in rates of growth—the Syrian, for example—are so few in number that the effect on *average* growth is most likely nil.

METHOD

The method of measurement was first to obtain plaster of Paris casts of maxillary and mandibular dentures; a very few impressions among the younger children were taken, with extreme care, in modeling compound. The positive of the impression, made by a specialist in the laboratories of the College of Dentistry, New York University, was then set upon a Stanton pantograph and

the teeth and arches were precisely projected orthographically five times their natural size. Measurements were taken on the enlarged projections. Dr. Ashley-Montagu[2] has already commented upon the reliability of this method and demonstrated the very slight and insignificant differences obtaining between measurements on flesh, model, and projection, respectively.

The centers of the teeth at the gum level, with a few exceptions which will be noted, were the landmarks or points of measurement.* Figs. 1 and 2 illustrate the various landmarks and diameters used in the present inquiry; the legend which follows explains these and the terminology.

WIDTHS OF THE MAXILLARY AND MANDIBULAR ARCHES

Combined Sexes.—The average widths and standard deviations† of the maxillary and mandibular arches from one to eleven years, irrespective of sex, are given in Table II. As an aid in visualizing the tabular material, the data are also presented graphically in Figs. 3 and 4.

An increment, greater or less in amount, is seen to occur at every width in the arches within the time limits considered. Of interest is also the definite

INCREMENTS IN WIDTHS FROM 2 TO 9 YEARS

ARCH	C-C		D-D		E-E		6-6		WIDTH	
	MM.	%	MM.	%	MM.	%	MM.	%	MM.	%
Maxillary	2.5	9.2	2.1	6.5	2.1	5.7	0.6	1.4	2.3	5.0
Mandible	2.5	11.5	2.7	9.2	1.8	5.0	1.25	3.0	2.1	4.8

acceleration of growth, more or less prolonged, beginning in the sixth year; this spurt is especially notable in the anterior (C–C) region. The general spurt in growth evident at this time is very likely the result of a need for space to accommodate the erupting permanent incisors and first molars. The apparent acceleration of growth at D–D between one and two years, and also during the tenth and eleventh year, noted in the tabular data, is in each instance of doubtful significance in view of the quite inadequate number of cases available in these age groups. For this reason the graphs will always represent growth from 2 to 9 years only.

*For method of determination of these points or "centroids," see Stanton, F. L., Fish, G. D., and Ashley-Montagu, M.F.: Description of Three Instruments for Use in Orthodontic and Cephalometric Investigations, With Some Remarks on Map Construction, J. Dent. Res. 11: 885, 1931.

†Standard deviations for a number of the measurements were obtained about a year ago for the series then available; these are included in Tables II and III. The number of cases and averages upon which these σ's were based are given separately below. An appreciable number of the σ's, however, had previously not been ascertained, and were therefore found for the present series. Calculation of the many σ's is a laborious and time-consuming task which, with the time at our command, could not possibly be done for all the figures of the larger series.

AGE (YEARS)		2		3		4		5		6		7		8	
C - C	U.	(24)	27.3	(59)	27.1	(80)	27.2	(74)	27.3	(58)	28.4	(57)	29.2	(47)	29.5
	L.	(26)	21.9	(59)	21.8	(81)	21.8	(74)	21.8	(58)	23.1	(58)	23.5	(43)	24.1
D - D	U.	(26)	32.4	(59)	32.8	(78)	32.8	(70)	33.0	(53)	33.9	(52)	34.1	(43)	34.4
	L.	(26)	29.4	(59)	29.7	(79)	29.6	(68)	29.2	(52)	29.7	(48)	30.1	(35)	30.4
E - E	U.	(13)	37.1	(54)	37.2	(79)	37.6	(73)	37.6	(54)	38.5	(52)	38.8	(43)	38.8
	L.	(16)	36.2	(58)	35.8	(80)	35.8	(68)	35.5	(51)	36.1	(49)	36.3		
6 - 6	U.									(28)	43.2	(52)	43.6	(47)	43.9
	L.									(25)	42.1	(45)	42.4		
Width	U.	(13)	46.3	(54)	46.4	(79)	46.9	(73)	46.8	(55)	47.8	(52)	48.0		
	L.														
Length	U.	(11)	29.0	(54)	28.4	(77)	28.2	(69)	28.4	(53)	28.3	(46)	28.2		
	L.														

TABLE II

AVERAGES AND VARIABILITIES OF WIDTHS IN THE ALVEOLAR ARCHES OF CHILDREN FROM 1 TO 11 YEARS (COMBINED SEXES)

AGE GROUP (YEARS)	C-C N.	C-C A.	C-C σ	D-D N.	D-D A.	D-D σ	E-E N.	E-E A.	E-E σ	6-6 N.	6-6 A.	6-6 σ	WIDTH N.	WIDTH A.	WIDTH σ
							A—Maxillary Arch								
1	(3)	27.0		(4)	31.2		(1)	36.8					(1)	45.7	
2	(32)	27.2	1.7	(35)	32.5	2.1	(18)	37.0	2.2				(18)	46.1	1.9
3	(84)	27.0	1.6	(84)	32.65	1.8	(81)	37.0	1.8				(78)	46.3	2.0
4	(98)	27.25	1.5	(94)	33.2	1.8	(97)	37.6	1.9	(1)	41.7		(96)	47.0	2.1
5	(89)	27.4	1.5	(85)	33.15	1.6	(88)	37.9	1.8	(8)	43.8		(88)	47.1	1.9
6	(74)	28.35	1.7	(68)	33.9	1.6	(70)	38.4	1.8	(36)	43.4	1.6	(71)	47.8	2.0
7	(66)	29.5	1.9	(60)	34.2	1.8	(61)	38.7	1.9	(59)	43.6	1.7	(61)	48.0	2.0
8	(50)	29.75	1.9	(47)	34.6	1.9	(45)	39.1	1.9	(51)	43.9	1.9	(45)	48.4	1.85
9	(31)	29.7	1.87	(33)	34.6	2.06	(33)	39.1	2.14	(37)	44.0	2.07	(31)	48.4	2.14
10	(12)	30.4		(11)	35.6		(12)	39.4		(14)	44.4		(12)	48.8	
11	(5)	30.4		(6)	36.5		(5)	40.7		(6)	45.0		(4)	49.35	
							B—Mandibular Arch								
1	(3)	22.1		(4)	29.2		(1)	36.4							
2	(35)	21.7	1.2	(35)	29.3	1.6	(22)	35.7	1.8				(21)	43.8	2.18
3	(84)	21.7	1.2	(84)	29.5	1.5	(83)	35.6	1.7				(82)	44.1	1.97
4	(98)	21.9	1.4	(96)	29.7	1.6	(97)	35.9	1.7				(97)	44.4	2.22
5	(89)	21.9	1.4	(82)	29.4	1.6	(83)	35.7	1.6	(9)	42.0		(83)	44.2	1.79
6	(74)	22.9	1.5	(66)	29.8	1.5	(66)	36.2	1.7	(36)	41.9	1.8	(65)	44.9	2.05
7	(67)	23.5	1.5	(54)	30.1	1.4	(56)	36.3	1.5	(52)	42.3	1.6	(56)	45.0	1.62
8	(49)	24.4	1.4	(38)	30.7	1.3	(45)	36.8	1.48	(51)	42.8	1.68	(45)	45.35	1.37
9	(31)	24.2	1.74	(28)	31.0	1.55	(30)	37.5	1.79	(37)	43.15	1.72	(30)	45.9	1.58
10	(10)	24.9		(9)	31.7		(10)	38.15		(13)	43.6		(8)	46.4	
11	(6)	23.5		(6)	31.6		(6)	37.0		(6)	43.2		(6)	45.5	

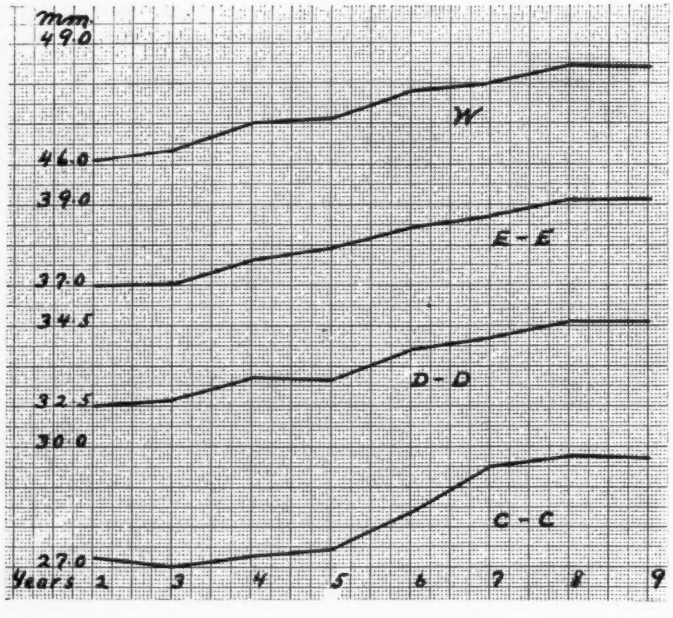

Fig. 3.—Widths of maxillary arch at successive ages (both sexes).

Figs. 3 and 4 also reveal that the anterior width proceeds at a more rapid rate of growth than either the middle or the posterior width. This acceleration can likewise be observed in the total absolute increments, given above,

at the various widths between 2 and 9 years, and is even more clearly discernible when the increments are considered as percentages of increase.

The total increment at the 6–6 region covers only 3 years. It is of interest, however, in showing an appreciably greater growth, absolutely and relatively, in the mandibular than the maxillary arch, which would seem to suggest a convergence of the respective arches with growth backward to accommodate the permanent molars.

Sex Differences.—As is well known, the sexes on the average manifest anatomical differences in size and proportions, and functionally vary in rates of growth. The attempt was therefore made to ascertain whether such differences existed in the alveolar arches according to the present material. Table III gives averages and ranges of the various widths in the two sexes. The phases

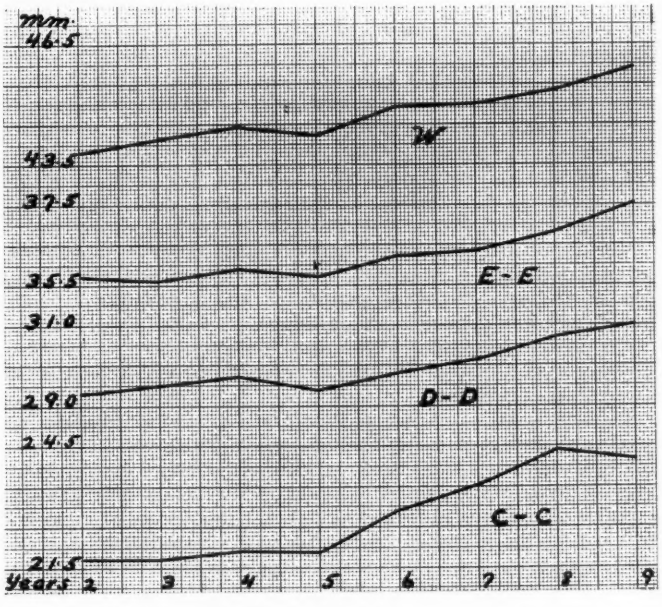

Fig. 4.—Widths of mandibular arch at successive ages (both sexes).

of acceleration and retardation can probably be better appreciated graphically, and are so presented in Figs. 5 and 6.

The arches are seen to be larger in the males at almost all ages. A tendency to greater fluctuation or instability of growth appears also characteristic of the males. Attention may be called to the peculiar trend in the maxillary arch for all the widths to diminish from 2 to 3 years in the males while increasing in the females. Comparing the differences between the sexes in the two arches, there is apparent a generally greater similarity of the males and females in the mandibular than in the maxillary arch.

The spurt in growth at 6 years, already noted in the discussion of the combined sexes, is found in each sex, and again appears more accentuated in the anterior region. Growth in the females proceeds at a more even, although, on the whole, faster tempo than in the males; this more accelerated growth

TABLE III

AVERAGES AND RANGES OF WIDTHS IN THE ALVEOLAR ARCHES FROM 1 TO 11 YEARS ACCORDING TO SEX

AGE (YEARS)		C-C		D-D		E-E		6-6		W.	
		M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
					A—Maxillary Arch						
1	N.	(1)	(2)	(1)	(3)		(1)				(1)
	A.	27.8	26.65	32.5	30.8		36.8				45.7
	R.		25.7–27.6		28.5–33.2						
2	N.	(14)	(18)	(17)	(18)	(8)	(10)			(9)	(9)
	A.	28.0	26.6	33.1	31.9	37.8	36.3			47.0	45.2
	R.	24.7–31.9	23.8–28.6	29.8–38.3	28.3–34.8	34.8–41.9	34.4–38.4			43.5–51.6	43.5–47.7
3	N.	(50)	(34)	(50)	(34)	(47)	(34)			(44)	(34)
	A.	27.3	26.7	32.8	32.4	37.2	36.7			46.6	45.85
	R.	23.8–31.5	23.7–29.8	28.2–38.1	28.7–35.2	30.6–42.5	32.7–39.5			40.3–52.2	41.5–48.7
4	N.	(52)	(46)	(49)	(45)	(51)	(46)		(1)	(50)	(46)
	A.	27.7	26.8	33.7	32.7	38.1	37.1		41.7	47.6	46.3
	R.	25.0–31.7	22.8–30.3	28.9–38.7	28.6–38.1	34.5–43.4	32.5–43.7			42.8–54.0	41.7–52.3
5	N.	(38)	(51)	(36)	(49)	(37)	(51)	(4)	(4)	(37)	(51)
	A.	27.6	27.2	33.5	32.9	38.4	37.5	44.0	43.7	47.5	46.8
	R.	25.2–30.1	22.9–31.2	31.2–35.6	28.9–38.6	36.1–40.7	33.0–44.2	43.2–46.0	42.5–45.3	45.4–50.8	41.5–52.4
6	N.	(36)	(38)	(33)	(35)	(33)	(37)	(19)	(17)	(34)	(37)
	A.	28.7	28.1	34.2	33.6	38.85	38.1	43.3	43.5	48.5	47.2
	R.	25.0–31.0	24.1–33.3	31.3–36.3	29.5–39.4	35.7–42.1	33.7–44.9	41.6–46.0	39.5–48.4	44.8–53.6	42.7–53.3
7	N.	(38)	(28)	(34)	(26)	(34)	(27)	(36)	(23)	(34)	(27)
	A.	29.75	29.2	34.4	33.8	39.1	38.3	43.85	43.15	48.5	47.45
	R.	24.5–32.4	26.1–33.7	30.2–36.9	31.0–38.0	35.0–41.8	34.6–41.7	40.8–48.1	38.4–46.2	44.4–51.5	43.4–50.7
8	N.	(27)	(23)	(26)	(21)	(23)	(22)	(30)	(21)	(23)	(22)
	A.	30.2	29.25	34.95	34.1	39.4	38.8	44.0	43.8	48.8	48.0
	R.	25.5–32.8	25.5–32.3	30.7–37.7	31.0–36.7	35.3–42.3	35.1–42.0	38.7–48.7	40.9–46.5	44.5–52.1	44.4–51.2
9	N.	(15)	(16)	(17)	(16)	(17)	(16)	(21)	(16)	(15)	(16)
	A.	30.3	29.2	35.1	34.2	39.8	38.4	44.4	43.6	49.1	47.7
	R.	26.1–33.2	25.9–32.1	31.2–37.7	31.0–37.5	35.9–43.0	34.9–42.1	39.1–47.8	40.8–47.2	45.7–52.4	44.5–51.3
10	N.	(7)	(5)	(5)	(6)	(5)	(7)	(7)	(7)	(5)	(7)
	A.	30.2	30.8	35.7	35.45	39.8	39.1	44.4	44.4	49.2	48.55
	R.	27.5–32.2	28.8–32.3	32.3–37.4	33.0–37.8	36.3–42.3	37.1–42.1	39.2–48.1	41.6–47.5	45.7–51.9	46.2–51.3
11	N.	(2)	(3)	(3)	(3)	(2)	(3)	(3)	(3)	(1)	(3)
	A.	30.4	30.4	36.4	36.7	40.35	41.0	43.8	46.2	46.6	50.3
	R.	28.2–32.6	28.8–31.3	32.5–38.8	31.9–39.1	37.0–43.7	37.7–42.8	40.3–48.0	43.2–48.1		46.7–52.1

TABLE III—CONT'D

AGE (YEARS)		C-C M.	C-C F.	D-D M.	D-D F.	E-E M.	E-E F.	6-6 M.	6-6 F.	W. M.	W. F.
					B—Mandibular Arch						
1	N.	(1)	(2)	(1)	(3)		(1)				
	A.	20.8	22.75	28.1	29.6		36.4				
	R.		22.7–22.8		28.2–30.9						
2	N.	(17)	(18)	(17)	(18)	(10)	(12			(9)	(12)
	A.	22.1	21.3	29.7	28.9	36.05	35.4			44.2	43.55
	R.	19.8–26.1	19.8–23.5	26.6–33.5	26.5–31.9	33.0–40.2	33.1–38.0			40.6–48.3	41.2–46.5
3	N.	(50)	(34)	(50)	(34)	(49)	(34)			(48)	(34)
	A.	21.85	21.5	29.8	29.1	35.9	35.1			44.6	43.55
	R.	19.6–25.0	19.2–24.4	26.3–33.6	25.9–31.7	31.8–40.5	30.9–38.2			40.0–49.2	39.1–46.9
4	N.	(52)	(46)	(50)	(46)	(51)	(46)			(51)	(46)
	A.	22.1	21.6	30.1	29.2	36.4	35.4			45.0	43.8
	R.	19.0–25.6	18.7–26.0	26.5–33.4	25.7–35.0	31.8–40.9	31.6–40.5			40.0–49.3	39.4–48.9
5	N.	(38)	(51)	(33)	(49)	(35)	(48)	(5)	(4)	(35)	(48)
	A.	21.9	21.9	29.4	29.4	35.7	35.7	42.3	41.7	44.3	44.2
	R.	19.3–25.4	18.9–27.0	27.2–32.6	25.5–34.8	33.6–38.3	31.0–40.6	41.0–45.8	40.8–42.3	42.0–46.8	38.5–49.4
6	N.	(36)	(38)	(33)	(33)	(33)	(33)	(18)	(18)	(33)	(32)
	A.	22.8	22.9	29.9	29.7	36.4	36.0	42.4	41.4	45.2	44.5
	R.	19.9–26.6	19.5–28.2	27.0–33.3	26.0–35.5	33.8–40.3	31.6–41.4	40.0–46.7	37.5–44.4	42.0–48.7	40.0–50.3
7	N.	(38)	(29)	(31)	(23)	(33)	(23)	(32)	(20)	(33)	(23)
	A.	23.7	23.2	30.3	29.9	36.6	35.9	42.8	41.5	45.3	44.5
	R.	20.7–26.5	20.8–27.1	27.1–33.1	26.7–33.3	33.8–40.3	32.6–38.8	40.1–46.8	38.6–44.0	42.6–48.4	41.2–47.4
8	N.	(28)	(21)	(23)	(15)	(26)	(19)	(30)	(21)	(26)	(19)
	A.	24.6	24.2	30.6	30.8	36.9	36.6	42.9	42.6	45.7	44.9
	R.	22.5–26.7	21.2–29.5	28.6–32.5	27.4–35.3	34.8–39.7	33.4–41.2	39.0–47.1	39.4–44.6	43.4–48.3	42.0–48.5
9	N.	(16)	(15)	(14)	(14)	(18)	(12)	(21)	(16)	(18)	(12)
	A.	24.5	24.0	30.9	31.2	37.3	37.7	43.4	42.8	46.1	45.7
	R.	22.0–26.8	20.5–29.7	29.1–32.8	27.6–35.8	34.9–40.0	34.1–42.2	39.3–47.4	39.8–44.9	43.6–48.6	42.5–48.5
10	N.	(5)	(5)	(4)	(5)	(5)	(5)	(7)	(6)	(4)	(4)
	A.	24.8	25.0	31.4	31.9	37.6	38.7	43.8	43.4	46.2	46.6
	R.	24.1–25.8	22.4–29.5	29.1–33.4	29.3–35.8	35.7–40.4	35.8–42.4	40.0–47.0	40.5–46.0	44.4–48.9	44.7–50.0
11	N.	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
	A.	23.8	23.2	31.2	32.0	36.7	37.3	43.0	43.4	45.3	45.7
	R.	22.5–24.8	22.7–23.7	29.9–32.8	30.6–32.8	35.5–37.7	35.4–38.6	40.4–45.2	41.0–45.0	42.8–47.0	42.7–47.2

Note: N is number of cases; A, average; R, range.

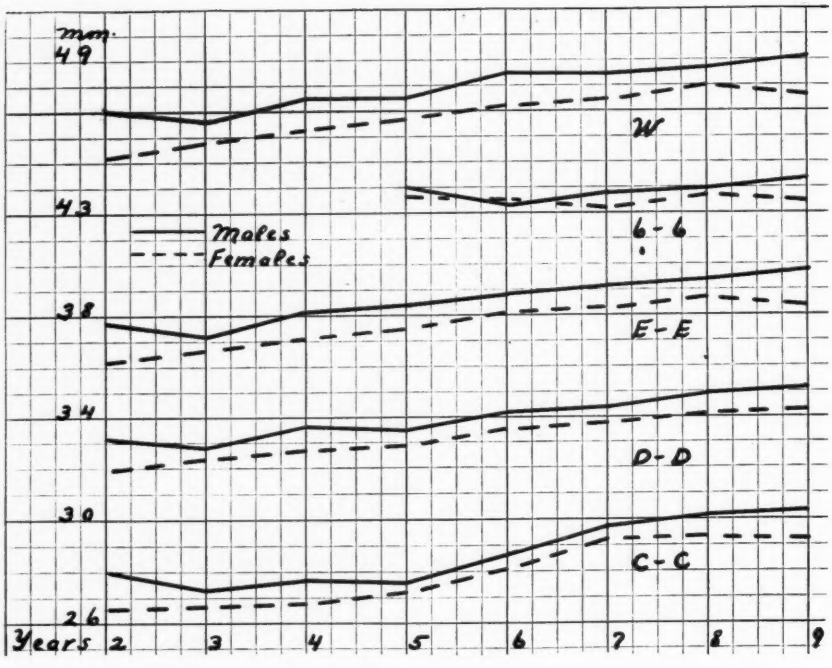

Fig. 5.—Widths of maxillary arch according to sex.

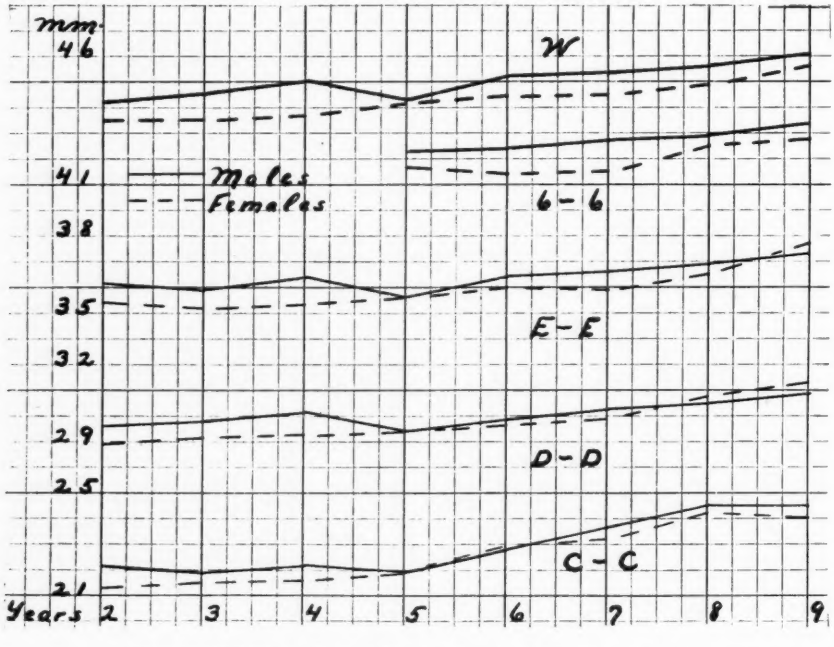

Fig. 6.—Widths of mandibular arch according to sex.

in the females can perhaps be better observed by noting their somewhat greater total increments from 2 to 9 years, given below.

INCREMENT (MM.) IN WIDTHS FROM 2 TO 9 YEARS IN EACH SEX

ARCH	C-C		D-D		E-E		6-6*		WIDTH	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Maxillary	2.3	2.6	2.0	2.3	2.0	2.1	1.1	0.1	2.1	2.5
Mandibular	2.4	2.7	1.2	2.3	1.25	2.3	1.0	1.4	1.9	2.15

*Increment only from 6 to 9 years inclusive.

Comparative Data.—Direct comparison of the absolute figures in the present study with those of other authors is scarcely feasible in view of the quite different methods of measurement employed by each. An attempt was made, however, to compare in detail the *rates* of growth as given by, or culled from, various contributors. Appreciable fluctuations occurred even among these, to an extent which could hardly be accounted for except by reason of the different methods used. A summary, however, of these comparative data on rates of growth is given below.

COMPARATIVE DATA OF GROWTH (MM.) BETWEEN 2 AND 9 YEARS INCLUSIVE AT VARIOUS WIDTHS IN THE ALVEOLAR ARCHES (BOTH SEXES)

	GOLDSTEIN AND STANTON	HELLMAN	SMYTH AND YOUNG	FRANKE	LEWIS AND LEHMAN
		Maxillary Arch			
C-C	2.5	2.3			5.26
D-D	2.1		3.64		3.06
E-E	2.1			4.7	1.9
Width	2.3	3.4			
6-6	0.6			1.8	
		Mandibular Arch			
C-C	2.5				2.4
D-D	2.7		2.27		1.27
E-E	1.8			2.4	2.12
Width	2.1	2.71			
6-6	1.25			1.8	

The increments according to the present study appear generally less than those found by the other investigators, a condition probably due to the fact that the other authors, excepting Hellman, had recourse to totally different groups of children at the various ages.

Brash[4] (p. 80) estimates the average increase of the arches per year, from 3½ to 16 years, as 0.42 mm. in the maxilla and 0.35 mm. in the mandible. Smyth and Young[10] (p. 47) give 0.51 mm. and 0.37 mm. annual increment in the maxillary and mandibular arches respectively, considering the widths between the second premolars from 3.5 to 13.5 years. The average yearly increment according to the present data, taken at the maximum width in the deciduous second molar region, is 0.33 mm. in the maxillary, and 0.30 mm. in the mandibular arch, between 2 and 9 years. These average yearly increments according to the several investigators do not appear greatly divergent, especially in view of dissimilar methods of measurement and, perhaps of greater significance, the difference in the spans of time considered.

Smyth and Young, in the British study, speak of a "spring-up" or spurt in growth in the D–D region between 5 and 9 years (p. 45). Definite acceleration, it will be recalled, within this age interval was likewise noted in the present investigation.

LENGTHS OF THE MAXILLARY AND MANDIBULAR ARCHES

The lengths considered in the present inquiry are defined in Figs. 1 and 2. They are the total (L), the anterior (A–C), and the posterior (C–E).

TABLE IV

AVERAGES AND VARIABILITIES OF LENGTHS IN THE ALVEOLAR ARCHES OF CHILDREN FROM 1 TO 11 YEARS (COMBINED SEXES)

AGE (YEARS)	LENGTH NO.	LENGTH A.	LENGTH σ	A-C NO.	A-C A.	A-C σ	C-E NO.	C-E A.	C-E σ
				A—Maxillary Arch					
1	(1)	28.0		(3)	6.5		(1)	15.2	
2	(16)	29.1	1.5	(33)	7.0	0.84	(18)	15.0	0.93
3	(78)	28.7	1.5	(84)	6.9	0.95	(81)	14.8	0.88
4	(94)	28.4	1.4	(97)	6.8	0.80	(98)	14.5	0.80
5	(82)	28.1	1.5	(84)	6.6	0.81	(88)	14.3	0.89
6	(69)	28.2	1.9	(71)	6.5	1.00	(73)	14.0	0.93
7	(54)	28.2	1.5	(61)	6.5	1.05	(63)	13.75	1.09
8	(48)	28.9	2.03	(51)	7.1	1.18	(46)	13.9	0.82
9	(33)	29.1	2.16	(33)	7.4	1.28	(31)	13.6	0.96
10	(13)	28.8		(14)	7.5		(12)	13.45	
11	(4)	30.3		(5)	7.6		(4)	13.7	
				B—Mandibular Arch					
1				(3)	3.8		(1)	13.9	
2	(21)	25.9	1.11	(35)	4.2	0.72	(22)	15.2	0.73
3	(82)	25.8	1.46	(83)	4.2	0.70	(82)	14.75	1.00
4	(96)	25.7	1.47	(97)	4.2	0.69	(97)	14.6	0.85
5	(85)	25.1	1.40	(84)	3.95	0.69	(83)	14.2	0.84
6	(74)	25.1	1.58	(74)	3.7	0.90	(68)	14.1	0.86
7	(67)	25.1	1.41	(67)	3.9	0.79	(59)	13.8	1.00
8	(54)	25.1	1.32	(51)	4.0	0.74	(45)	13.8	0.93
9	(38)	24.75	1.53	(36)	4.0	0.75	(30)	13.5	1.02
10	(14)	24.6		(11)	4.2		(9)	12.9	
11	(6)	24.8		(6)	4.1		(6)	13.0	

Combined Sexes.—The averages and standard deviations for each diameter in maxillary and mandibular arches, irrespective of sex, are given in Table IV and depicted graphically in Fig. 7.

The *total length*, which in the present inquiry is equivalent to the length of the deciduous arch, does not increase in size. At 9 years it is precisely the same in the maxillary arch as it had been at 2 years, while in the mandibular arch there has actually been a decrease. The maxillary length had as a matter of fact also diminished until the eighth year, when a spurt in growth apparently occurred which offset the previous loss.

A steady and practically uninterrupted reduction is observed in the *posterior (C–E) length*. The size and mode of regression of this diameter appear remarkably similar in the two arches (Fig. 7).

The *anterior* (*A–C*) *region,* especially in the maxillary arch, exhibits quite a different growth curve than did the posterior. A definite acceleration in growth is here discernible at 8 and 9 years, making the anterior segment almost 0.5 mm. *longer* at 9 than it had been at 2 years. This lengthening in the maxillary arch, moreover, has occurred while the A–C of the mandibular arch remained practically stable, even evincing a slight diminution.

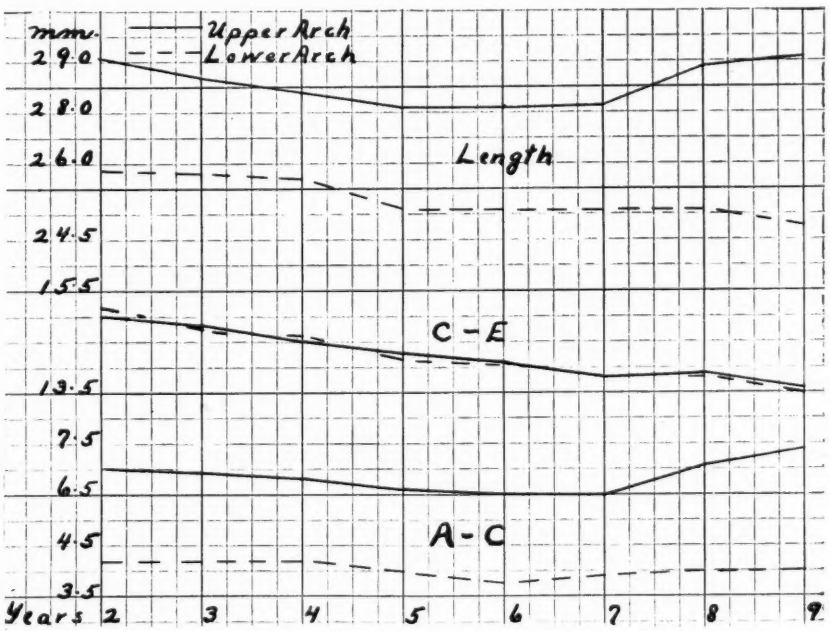

Fig. 7.—Various lengths in the alveolar arches (both sexes).

Sex Differences.—The data for the various lengths according to sex, are presented in Table V. They are graphically interpreted in Figs. 8 and 9. As noted in the widths, the females manifest in general a more regular mode of growth than do the males. Moreover, total reduction is usually less, and total increment more, in the females than in the males.

Total Increment or Decrement (mm.) in the Various Lengths Between 2 and 9 Years

	A-C			C-E			L.		
	M.	F.	M. & F.	M.	F.	M. & F.	M.	F.	M. & F.
Maxillary	0.6	0.3	0.4	–1.7	–1.2	–1.4	–0.4	0.5	0.0
Mandibular	–0.8	0.3	–0.2	–2.05	–1.5	–1.7	–2.0	–0.5	–1.15

Of interest is the increase of total length in the maxillary arch of the females as contrasted with the diminution in the males. A like trend is noted in the mandibular A–C. The differences between the anterior and the posterior lengths appear even more clearly defined in the two sexes than occurred in the consideration of the combined sexes.

Discussion.—Stability or reduction of the arch containing the deciduous dentition has been noted and commented upon by numerous authorities (Hunter, Hellman, Young and others). Each writer, however, had considered

the total length only, which in the present investigation likewise manifests either stability or even some reduction. A more refined analysis, on the other hand, by breaking up the total lengths before and behind the canine teeth,*

TABLE V

AVERAGES AND RANGES OF LENGTHS IN THE ALVEOLAR ARCHES FROM 1 TO 11 YEARS ACCORDING TO SEX

AGE (YEARS)	SEX	LENGTH (L) NO.	A.	R.	A-C NO.	A.	R.	C-E NO.	A.	R.
					A—Maxillary Arch					
1	M.				(1)	6.1				
	F.	(1)	28.0		(2)	6.7	5.8-7.5	(1)	15.2	
2	M.	(8)	29.8	27.0-31.3	(15)	7.2	5.1-8.5	(8)	15.3	13.6-16.3
	F.	(8)	28.4	26.8-30.6	(18)	6.8	5.6-8.3	(10)	14.8	13.4-16.2
3	M.	(44)	29.4	26.8-32.2	(50)	7.2	5.1-9.5	(47)	15.1	13.6-17.0
	F.	(34)	27.8	24.7-31.2	(34)	6.55	4.9-8.5	(34)	14.3	13.0-16.0
4	M.	(49)	28.9	25.5-31.8	(52)	6.9	4.8-9.3	(52)	14.8	13.2-16.7
	F.	(45)	27.95	25.1-30.8	(45)	6.7	5.2-8.1	(46)	14.2	11.8-15.7
5	M.	(36)	28.4	25.7-32.0	(36)	6.7	4.7-9.1	(37)	14.5	12.8-16.4
	F.	(46)	28.0	24.5-31.5	(48)	6.6	4.8-7.9	(51)	14.1	11.8-15.7
6	M.	(34)	28.5	25.0-34.9	(35)	6.6	4.6-9.2	(35)	14.1	11.9-15.7
	F.	(35)	27.9	23.9-30.6	(36)	6.4	3.9-8.6	(38)	13.9	10.7-15.8
7	M.	(32)	28.2	23.9-32.2	(36)	6.8	5.3-9.1	(36)	13.7	10.3-15.5
	F.	(22)	28.1	24.9-30.7	(25)	6.2	4.1-8.2	(27)	13.8	10.2-15.5
8	M.	(25)	29.2	24.1-32.0	(28)	7.6	5.9-9.5	(24)	13.9	11.4-15.5
	F.	(23)	28.5	25.2-32.3	(23)	6.6	4.4-8.6	(22)	13.85	12.3-15.5
9	M.	(16)	29.4	24.6-32.1	(17)	7.8	6.1-9.3	(15)	13.6	10.9-15.1
	F.	(17)	28.9	24.8-32.4	(16)	7.1	4.5-9.3	(16)	13.6	11.2-15.2
10	M.	(6)	27.9	25.2-31.0	(7)	7.7	5.9-9.9	(5)	12.9	11.5-13.9
	F.	(7)	29.65	27.3-33.0	(7)	7.4	5.2-8.6	(7)	13.8	12.1-15.5
11	M.	(1)	31.1		(2)	8.2	8.0-8.4	(1)	13.5	
	F.	(3)	30.0	28.3-33.3	(3)	7.1	6.6-7.9	(3)	13.8	12.9-15.0
					B—Mandibular Arch					
1	M.				(1)	2.4				
	F.				(2)	4.45	4.1-4.8	(1)	13.9	
2	M.	(9)	26.5	24.8-27.0	(17)	4.5	2.3-5.4	(10)	15.5	13.8-16.8
	F.	(12)	25.5	23.6-27.2	(18)	3.9	2.7-5.1	(12)	15.0	14.3-16.1
3	M.	(48)	26.1	23.2-28.4	(49)	4.2	2.3-5.9	(48)	15.0	12.6-16.8
	F.	(34)	25.3	22.2-27.6	(34)	4.25	3.2-5.3	(34)	14.4	12.7-16.2
4	M.	(50)	26.2	22.9-30.0	(51)	4.3	2.8-6.6	(51)	14.9	12.8-16.6
	F.	(46)	25.1	23.0-27.5	(46)	4.0	2.7-5.4	(46)	14.3	12.4-16.0
5	M.	(35)	25.3	21.8-28.0	(34)	4.1	3.0-6.1	(34)	14.5	12.8-15.7
	F.	(50)	24.9	22.1-27.8	(50)	3.8	2.1-5.3	(49)	14.0	12.0-16.1
6	M.	(36)	25.2	21.7-27.8	(36)	3.5	1.3-5.3	(33)	14.2	12.0-15.6
	F.	(38)	25.0	21.5-29.6	(38)	3.9	2.4-6.1	(35)	14.0	12.5-16.3
7	M.	(39)	25.05	21.4-27.4	(38)	3.9	1.9-5.5	(34)	13.75	10.3-15.4
	F.	(28)	25.2	22.9-29.4	(29)	4.0	2.5-5.8	(25)	13.9	12.2-15.8
8	M.	(30)	25.1	22.4-27.3	(28)	3.9	2.4-5.5	(25)	13.7	10.3-15.3
	F.	(24)	25.1	23.4-28.7	(23)	4.1	2.6-5.6	(20)	13.85	12.8-15.5
9	M.	(21)	24.5	21.7-26.8	(19)	3.7	2.4-5.0	(16)	13.45	10.0-14.5
	F.	(17)	25.0	23.1-28.5	(17)	4.2	3.3-5.8	(14)	13.5	12.0-15.9
10	M.	(7)	24.0	21.9-26.9	(5)	4.0	2.7-5.3	(3)	12.9	11.3-14.0
	F.	(7)	25.1	23.1-28.4	(6)	4.3	2.9-6.0	(6)	12.9	11.0-14.4
11	M.	(3)	25.5	24.0-27.6	(3)	4.2	3.4-4.9	(3)	13.2	11.8-14.5
	F.	(3)	24.1	22.7-25.9	(3)	4.0	3.0-4.7	(3)	12.8	11.5-13.4

*The total length (L) is esentially composed of the combined A—C and C—E diameters.

has demonstrated varying modes of growth in these particular segments, with actually an increment in the anterior portion of the maxillary arch.

The reduction of length, especially in the posterior region (C–E) of the arches between 2 and 9 years is probably due, first, to the fact that the eruption of the larger permanent incisors has a definite tendency to push the canines back,

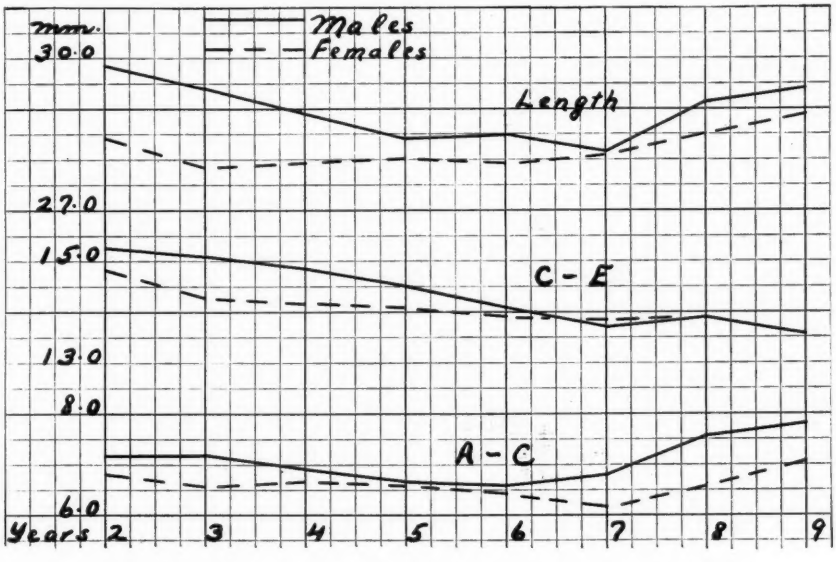

Fig. 8.—Lengths in the maxillary alveolar arches in each sex.

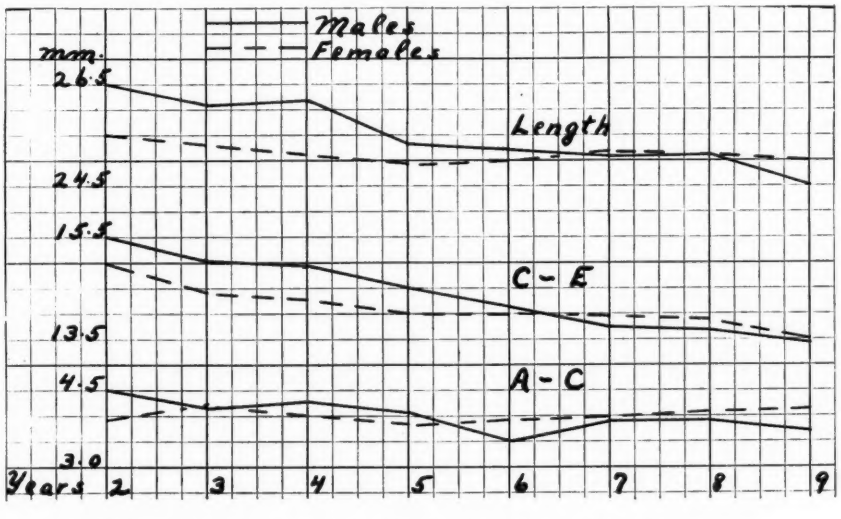

Fig. 9.—Lengths in the mandibular alveolar arches in each sex.

closing the greater or less space usually found between the deciduous canine and the first molar. Second, the frequent premature loss of the deciduous molars, usually due to caries, must have some effect on the reduction noted in this region. When it is the deciduous first molar which is prematurely lost, and it seems to be more commonly so affected, there is, no doubt, a shifting forward of the deciduous second molar and a backward movement of the canine.

It may be noteworthy that Smyth and Young[10] data (p. 42) indicate a spurt of growth in total length, for both males and females, at 9 years, corresponding to the acceleration noted in this diameter at 8 and 9 years in the present study.

The widths and lengths of each arch have been considered separately for the sake of convenience in presentation. Both, however, are components of a single whole. It was felt, therefore, that a composite representation of the

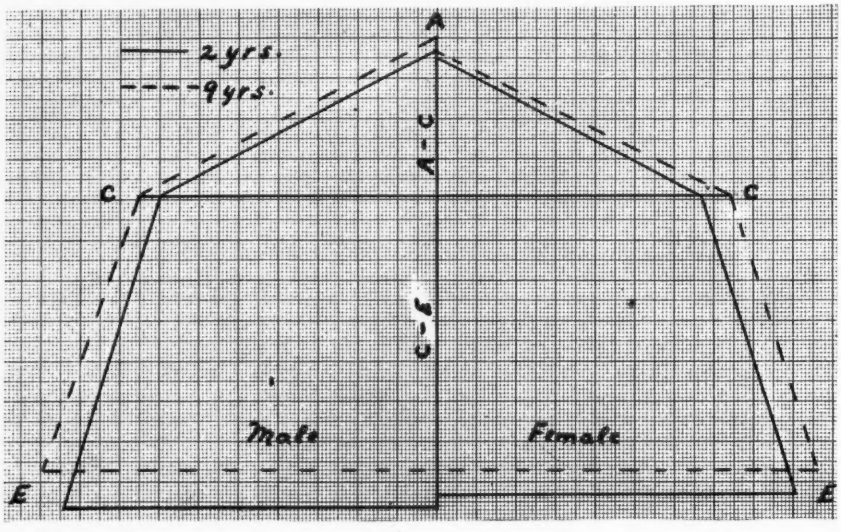

Fig. 10.—Composite view of total growth in all dimensions of the maxillary arch between 2 and 9 years.

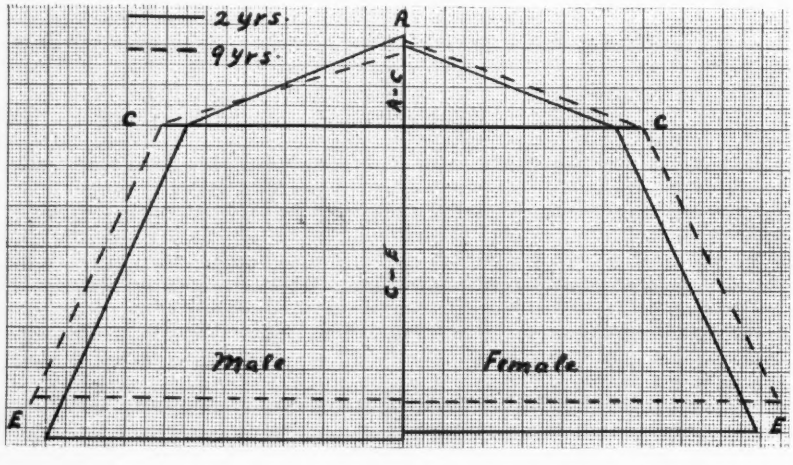

Fig. 11.—Composite view of total growth in all dimensions of the mandibular arch between 2 and 9 years.

total average growth, or lack thereof, between 2 and 9 years, in all dimensions, should prove illuminating. Such a picture is presented in Figs. 10 and 11. The bicanine width was taken as a base, and the average dimensions in the 2- and 9-year groups, respectively, were plotted from this base. Caution must be advised in interpreting these charts. They are necessarily schematic; the decrease in length noted posteriorly, for example, does not signify that the direction of diminution had only been from the deciduous second molars

anteriorward; this is not known and cannot be ascertained from the diagrams. Rather, as was mentioned, the main value of the charts is in delineating the end-results of growth in the several diameters in one comprehensive view.

FORM OF THE ALVEOLAR ARCHES

The terms "growth" and "development" are not infrequently used synonymously. There is, however, an appreciable distinction. Aside from conveying the idea of increasing complexity, as is suggested by the White House Conference on Child Health Protection[11] (p. 53), the term "development," we think, especially with reference to bony growth, may also connote changed proportions, more or less related to age, and brought about by varying rates of growth. The face of the adult, for example, is quite different from that of the infant, largely because of changed proportions caused by different rates of growth in separate regions.

Varying rates of growth were observed in the several diameters of the alveolar arches. How these variations affected proportion, which in the

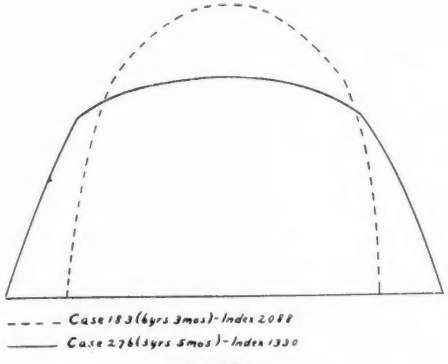

Fig. 12.*

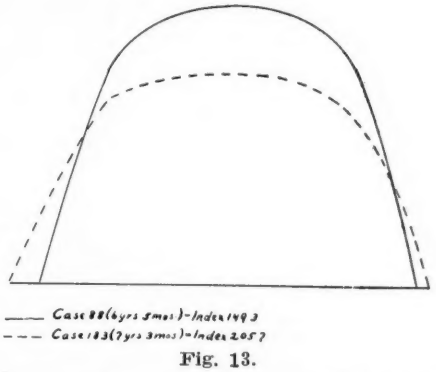

Fig. 13.

Fig. 12.—Total range of W/L indices in the maxillary alveolar arch represented by actual forms.

Fig. 13.—Total range of W/L indices in the mandibular alveolar arch represented by actual forms.

alveolar region is closely tied up with form, will be the subject matter for the following analyses:

Width-Length Index.—The relation of total length to total width is expressed by this index (W/L); the greater the width relative to the length, the larger the index, and when vice versa, the smaller the index. In Table VI are the average width/length indices at the successive ages.

Both maxillary and mandibular arches are seen to become relatively broader between 2 and 9 years. This phenomenon is especially notable in the mandibular arch, where the relative broadening is continuous and proceeds at a greater rate than is apparent in the maxillary arch.

Changes in linear proportions based on dimensions within a circular segment, as of the alveolar arch, should have palpable effects on the form of the curve concerned. In Figs. 12 and 13 are represented actual cases corresponding to the lowest and the largest width/length index in the respective arches. The differences in form are obvious and striking.

*The legend is reversed. Index 208.8 is the continuous line, and Index 133.0 the broken line.

The large range in form so well expressed by the extreme indices suggested subdivisions covering this range. Three subdivisions were made in the maxillary arch: the Dolichuranic, or relatively long arch, represented by

TABLE VI

AVERAGE INDICES AND VARIABILITIES IN THE ALVEOLAR ARCHES OF CHILDREN FROM 1 TO 11 YEARS

AGE (YEARS)	WIDTH/LENGTH M.	F.	M. AND F.	σ	A–C/C–C M.	F.	M. AND F.	σ	C–C/E–E M.	F.	M. AND F.	σ
					A—Maxillary Arch							
1		(1)	(1)		(1)	(2)	(3)			(1)	(1)	
		163.2	163.2		21.9	25.1	23.9			75.0	75.0	
2	(8)	(8)	(16)		(14)	(18)	(32)		(8)	(10)	(18)	
	158.0	160.0	158.8	7.90	25.6	25.7	25.6	3.26	74.2	73.6	74.0	1.81
3	(44)	(34)	(78)		(50)	(34)	(84)		(47)	(34)	(81)	
	158.95	165.0	161.2	9.99	26.3	24.6	25.6	3.28	73.3	72.6	73.0	2.29
4	(49)	(45)	(94)		(52)	(45)	(97)		(51)	(46)	(97)	
	165.2	165.7	165.3	8.31	24.9	25.0	24.9	2.59	72.5	72.2	72.3	2.43
5	(36)	(46)	(82)		(36)	(48)	(84)		(37)	(51)	(88)	
	167.4	167.2	167.3	9.07	24.2	24.2	24.2	2.78	71.8	72.4	72.2	2.65
6	(33)	(35)	(68)		(35)	(36)	(71)		(33)	(37)	(70)	
	170.8	168.5	169.1	11.22	23.0	23.1	23.0	3.27	73.5	73.8	73.5	3.07
7	(31)	(22)	(53)		(36)	(25)	(61)		(34)	(27)	(61)	
	170.6	169.4	170.1	11.58	22.8	21.3	22.1	3.19	76.0	76.4	76.15	3.92
8	(23)	(22)	(45)		(27)	(23)	(50)		(21)	(22)	(43)	
	165.6	167.2	166.4	11.43	25.25	22.5	24.0	3.72	76.2	75.5	75.85	3.56
9	(15)	(16)	(31)		(15)	(16)	(31)		(12)	(16)	(28)	
	165.2	163.8	164.5	13.23	25.8	24.1	24.9	4.00	75.8	76.7	76.0	4.20
10	(5)	(7)	(12)		(7)	(5)	(12)		(5)	(5)	(10)	
	173.2	163.7	167.6		25.4	22.9	24.4		74.4	77.7	76.0	
11	(1)	(3)	(4)		(2)	(3)	(5)		(1)	(3)	(4)	
	149.8	167.4	162.9		27.1	23.5	24.85		76.2	74.4	74.7	
					B—Mandibular Arch							
1					(1)	(2)	(3)			(1)	(1)	
					11.5	19.55	17.0			62.3	62.3	
2	(9)	(12)	(21)		(17)	(18)	(35)		(10)	(12)	(22)	
	167.4	170.4	168.9	9.39	20.3	18.2	19.2	3.20	62.1	60.9	61.5	1.48
3	(48)	(34)	(82)		(49)	(34)	(83)		(49)	(34)	(83)	
	171.2	172.4	171.4	9.49	19.4	19.8	19.6	3.12	60.8	61.1	60.9	2.30
4	(50)	(46)	(96)		(51)	(46)	(97)		(51)	(46)	(97)	
	172.0	174.8	173.1	9.17	19.4	18.7	19.25	3.02	60.8	61.0	60.9	2.37
5	(32)	(48)	(80)		(34)	(50)	(84)		(35)	(48)	(83)	
	173.4	177.2	175.5	9.22	18.8	17.3	18.0	3.19	61.3	61.5	61.4	2.94
6	(33)	(32)	(65)		(36)	(38)	(74)		(33)	(33)	(66)	
	178.6	176.6	177.3	10.54	15.4	17.0	16.2	3.77	62.7	63.7	63.2	3.31
7	(33)	(23)	(56)		(38)	(29)	(67)		(33)	(23)	(56)	
	179.3	174.2	177.4	11.56	16.3	17.5	16.75	3.16	64.9	64.3	64.7	3.30
8	(26)	(19)	(45)		(28)	(21)	(49)		(24)	(16)	(40)	
	180.8	176.4	178.8	9.53	15.9	16.6	16.2	2.98	66.3	65.7	66.1	4.20
9	(18)	(12)	(30)		(16)	(15)	(31)		(13)	(11)	(24)	
	186.1	179.1	183.2	12.15	15.35	17.6	16.4	3.36	64.6	64.1	64.4	3.59
10	(4)	(4)	(8)		(5)	(5)	(10)		(3)	(3)	(6)	
	194.1	179.0	186.2		16.1	17.3	16.7		64.6	63.8	64.2	
11	(3)	(3)	(6)		(3)	(3)	(6)		(3)	(3)	(6)	
	177.7	189.2	183.3		17.5	17.1	17.3		64.8	62.3	63.5	

NOTE: The average indices were calculated from the totals in the absolute measurements, and not according to the summation of the individual indices. A more accurate average is thereby obtained.

indices ranging up to 158.9; the Mesuranic, or relatively medium arch, represented by indices from 159.0 to 184.1; and the Brachyuranic, or relatively broad arch, represented by an index of 184.2 and over. It is to be under-

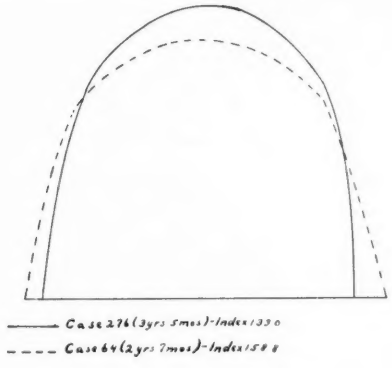

Fig. 14.

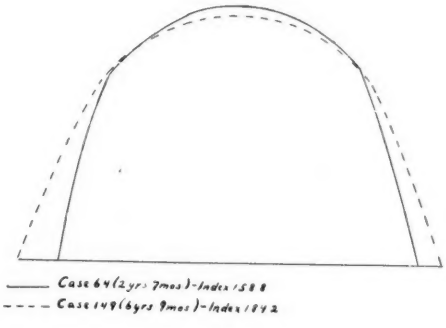

Fig. 15.

Fig. 14.—Range of the Dolichuranic form in the maxillary alveolar arches.
Fig. 15.—Range of the Mesuranic form in the maxillary alveolar arches.

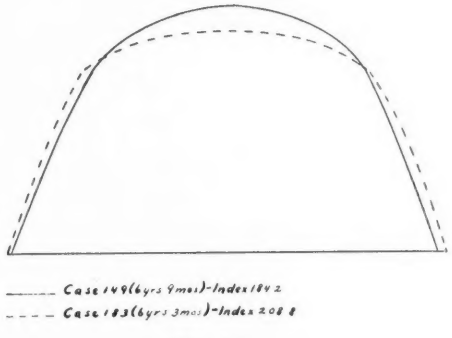

Fig. 16.

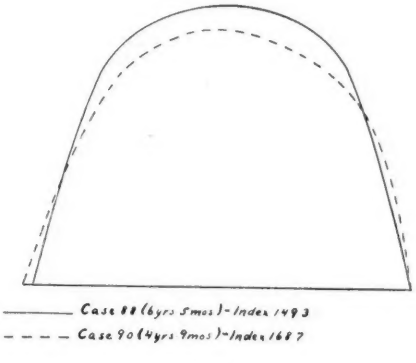

Fig. 17.

Fig. 16.—Range of the Brachyuranic form in the maxillary alveolar arches.
Fig. 17.—Range of the Dolichuranic form in the mandibular alveolar arches.

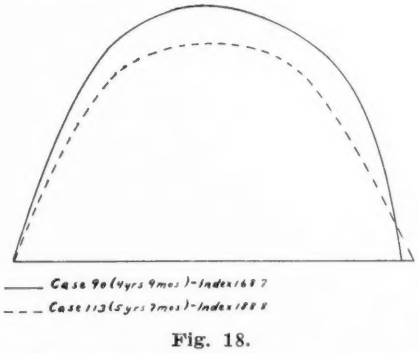

Fig. 18.

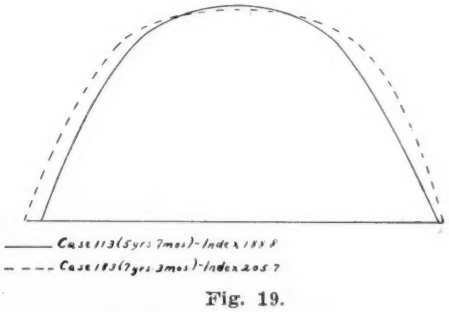

Fig. 19.

Fig. 18.—Range of the Mesuranic form in the mandibular alveolar arches.
Fig. 19.—Range of the Brachyuranic form in the mandibular alveolar arches.

stood as a matter of course that a Mesuranic arch with an index of 184.0 will probably not differ at all from a Brachyuranic form with an index of 184.7 or even 185.0. Demarcation must needs be made somewhere, but differences will naturally be at a minimum at the points of demarcation.

A similar procedure of division into types was followed in the mandibular arch. An important difference, however, must be noted. Since the mandibular arch is normally shorter but scarcely less wide than the maxillary, the indices of the mandibular arch will necesarily be generally higher and not strictly comparable with the indices of the maxillary arch. The upper limit of the Dolichuranic in the mandibular arch was therefore placed at 168.9; Mesuranic, 169.0-188.9; Brachyuranic, 189.0 and over. These subdivisions are seen to be substantially valid by noting in Figs. 14 to 19 the corresponding actual variations in form within the limits of the types propounded.

A further analysis is made as to whether these type forms varied with age. Table VII presents the results. In the maxillary arch, and only to a somewhat less degree in the mandibular arch, is apparent a strikingly high percentage of the relatively long, Dolichuranic type at 2 years; no Brachyur-

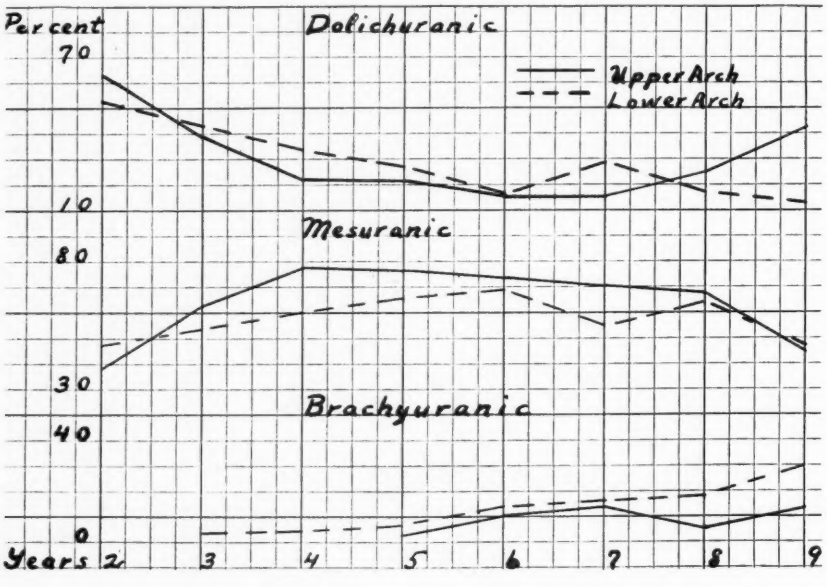

Fig. 20.—Distribution of width/ length proportions of maxillary and mandibular alveolar arches (both sexes).

anic form at all is perceived in this age. The arches thereafter however, become with increasing frequency relatively broader, falling preponderantly within the Mesuranic category. The relatively very broad or Brachyuranic type does not become evident until the fifth year in the maxillary arch, but is already present at 3 years in the mandibular arch. Fig. 20 shows the process of type changes graphically, indicating perhaps more clearly the trends noted above.

The behavior of the indices can readily be understood when it is recalled not only that the absolute total width had increased with age, but also that the length had actually decreased as well. And with respect to the differences between the maxillary and the mandibular arches, although growth in width was slightly more in the maxillary arch, the diminution in absolute length was proportionately greater in the mandibular arch.

Considering the whole series from 2 to 9 years, the Mesuranic arch is seen (Table VII) to be by far the most common, the Dolichuranic arch following, and the very broad or Brachyuranic form the least frequent.

TABLE VII

PERCENTAGE OF THE THREE TYPE-FORMS IN THE WIDTH/LENGTH INDEX (COMBINED SEXES)

AGE (YR.)	MAXILLARY ARCH						MANDIBULAR ARCH					
	DOLICHURANIC (X–158.9)		MESURANIC (159.0–184.1)		BRACHYURANIC (184.2–X)		DOLICHURANIC (X–168.9)		MESURANIC (169.0–188.9)		BRACHYURANIC (189.0–X)	
2	(10)	62.5	(6)	37.5			(11)	52.4	(10)	47.6		
3	(30)	38.5	(48)	61.5			(35)	42.7	(44)	53.7	(3)	3.6
4	(21)	22.3	(73)	77.7			(33)	34.4	(58)	60.4	(5)	5.2
5	(17)	20.7	(63)	76.8	(2)	2.5	(22)	27.5	(52)	65.0	(6)	7.5
6	(11)	16.2	(50)	73.5	(7)	10.3	(11)	16.9	(45)	69.2	(9)	13.8
7	(9)	16.7	(38)	70.4	(7)	12.9	(16)	28.6	(31)	55.4	(9)	16.0
8	(11)	25.0	(30)	68.2	(3)	6.8	(8)	17.8	(29)	64.4	(8)	17.8
9	(13)	41.9	(14)	45.2	(4)	12.9	(4)	13.3	(14)	46.7	(12)	40.0
2–9	(122)	26.1	(322)	69.0	(23)	4.9	(140)	29.5	(283)	59.6	(52)	10.9

NOTE: The figures in the brackets are number of cases; the other figures are the percentages.

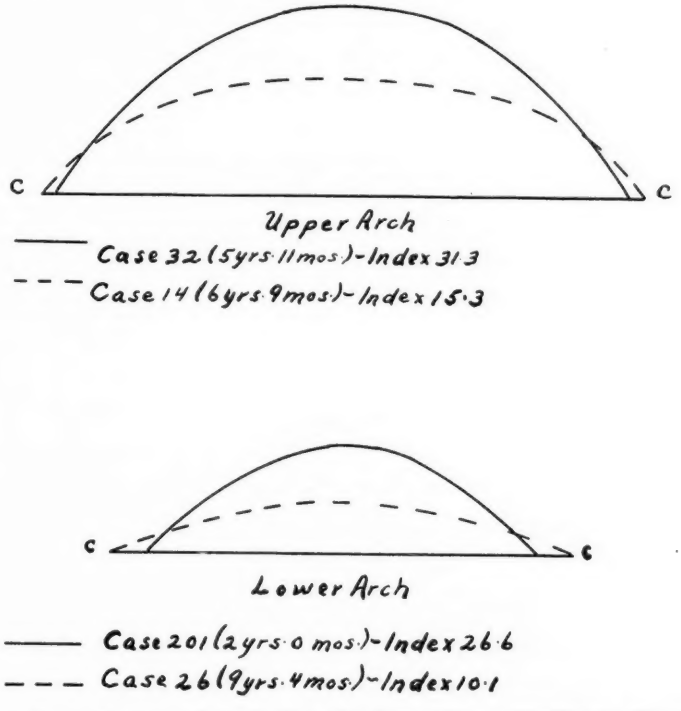

Fig. 21.—Range of anterior curvature in the alveolar arches according to the extremes of the A – C/C –C indices.

There is apparently very little difference between the sexes in average width/length form.

Anterior Form (A–C/C–C).—The anterior length and width have respectively been considered, and a correlation of these in the form of an index should give a good idea of the anterior curve in the alveolar arches. It is recognized, of course, that the shorter the length relative to the width, the

lower the index and the more blunt will be the anterior curve. In Table VII are included the average indices at the various ages. These are seen to become progressively less, more markedly so in the mandibular arch. In other words, the anterior curve becomes more blunt with age, corresponding to the general relative broadening observed in the arch as a whole.

The relationship of indices to form is illustrated in Fig. 21, in which the actual range in the anterior curvature is depicted according to the index limits.

The Posterior Index (C–C/E–E).—This index was formulated to show the divergence of the sides in the posterior section of the arch. It corresponds more or less to the angulation of the line connecting the canine and deciduous second molar with the X–X′ axis of the denture (Fig. 2). Moreover, changes in this index should indicate the greater or lesser rate of growth in the anterior width relative to the posterior width. Such changes, namely a proportionately greater growth in the anterior width than in the posterior, are indicated by the C–C/E–E indices in Table VI. Now, if the C–E length had remained unchanged, the divergence of the sides would have become less as a result of

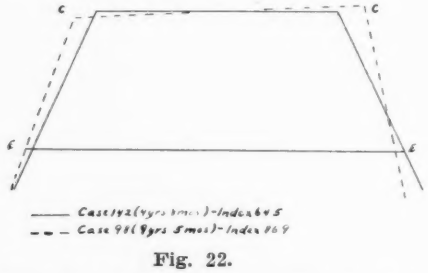

Fig. 22.

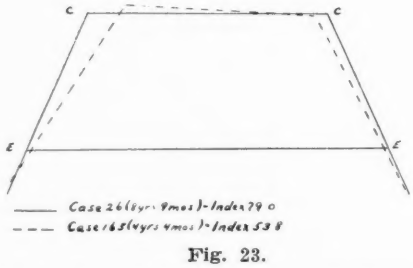

Fig. 23.

Fig. 22.—Range of divergence in the posterior sides of the maxillary alveolar arches according to the C—C/E—E indices.

Fig. 23.—Range of divergence in the posterior sides of the mandibular alveolar arches according to the C—C/E—E indices.

the greater growth in the anterior region (C–C). On the contrary, however, a rather appreciable decrease occurs in the C–E diameter between 2 and 9 years, which in turn tends to increase the divergence of the sides. The more parallel sides which would be expected from the increasing C–C/E–E index. or greater widening of the anterior width, is consequently entirely offset by the diminishing C–E length; and the angulation of the sides is practically the same at 9 years as it was at 2 years.

A better index could probably be formulated which would include the factor of length and thus be more valid in its interpretation of degree of divergence or form in the posterior aspect of the arch.

It was felt, nevertheless, that the differences in posterior form as represented by the extremes of the indices would be of interest, and the actual total variability is therefore presented in Figs. 22 and 23.

The A–C/C–E Index.—This, the last index to be considered, concerns length only. Practically the whole length of the deciduous arch had been split into two parts, an anterior and a posterior segment. It has already been

shown that the former differs in growth from the latter. How much the difference is proportionately, and the changes in these proportions with age, are represented by the A–C/C–E indices in Table VIII.

TABLE VIII

THE AVERAGE ANTEROPOSTERIOR LENGTH INDEX (A–C/C–E) AT SUCCESSIVE AGES

AGE	MAXILLARY ARCH				MANDIBULAR ARCH			
(YEARS)	M.	F.	M. AND F.	σ	M.	F.	M. AND F.	σ
1		(1) 38.2	(1) 38.2			(1) 34.5	(1) 34.5	
2	(8) 49.6	(10) 46.8	(18) 48.0	4.86	(10) 29.5	(12) 26.3	(22) 27.7	4.43
3	(47) 47.3	(34) 45.7	(81) 46.9	5.82	(48) 28.4	(34) 29.5	(82) 28.8	4.49
4	(52) 46.8	(45) 47.1	(97) 46.8	5.43	(50) 29.2	(46) 28.9	(96) 28.8	4.70
5	(35) 46.2	(48) 46.7	(83) 46.4	5.62	(31) 28.9	(49) 27.3	(80) 28.0	4.44
6	(34) 47.0	(36) 46.3	(70) 46.65	6.96	(33) 25.1	(35) 27.7	(68) 26.5	5.70
7	(34) 50.0	(24) 45.9	(58) 48.1	9.81	(34) 27.5	(25) 29.0	(59) 28.1	6.60
8	(24) 53.4	(22) 48.0	(46) 50.7	8.07	(25) 28.0	(20) 29.1	(45) 28.5	6.45
9	(15) 56.65	(16) 51.8	(31) 54.2	9.31	(16) 27.1	(14) 31.0	(30) 28.95	6.63
10	(5) 55.3	(7) 53.3	(12) 54.1		(3) 29.9	(6) 33.2	(9) 32.1	
11	(1) 59.3	(3) 51.8	(4) 53.6		(3) 31.6	(3) 31.1	(6) 31.3	

In the maxillary arch is noted a decrease in the anterior segment relative to the posterior from 2 to 6 years, but is seen to become increasingly greater from 7 to 9 years when the index is appreciably larger than at 2 years. In the mandibular arch a steady rise is apparent in the index at each age. The total increase, however, is less than had occurred in the maxillary arch. In brief, the anterior segment not only is a greater percentage of total length in the maxillary arch than it is in the mandibular arch, but between 2 and 9 years also increases its extent appreciably more in the maxillary arch than in the mandibular arch.

STATISTICAL REVIEW

A review of variability will be all that can be attempted in the present inquiry. More refined statistical treatment, however, if desired is possible from the material made available.

The standard deviation, it will be recalled, simply would mean with reference to the present study that 68 children out of any 100 will most likely possess the average alveolar diameter noted, whatever it might be, *plus* and *minus* the amount calculated and placed under sigma (σ).* In other words, the greater of two standard deviations of similar averages, each based on reasonably large numbers, would indicate higher variability.

The standard deviation was calculated for only the combined sexes within the 2-to-9-year age groups. This procedure assured fairly adequate numbers upon which the significance of the σ is so much dependent. A general tendency is noted throughout the absolute dimensions in the maxillary arch, and is even perceptible in the C–C of the mandibular arch, for variability to increase with age. This trend is unmistakable in the indices of both maxillary and mandibular arches. Shape of the alveolar arches, in other words, seems progressively more variable between 2 and 9 years. The phenomenon of higher

*The Greek σ is the symbol used for standard deviation.

variability of growth accompanying advancing age, at least up to the pubertal stage, has been noted before in the growth of other structures of the body.[3]

The mandibular arch generally manifests a more conservative variability than does the maxillary arch, a tendency which was also observed in the graphs. This difference would be expected in view of the fact that the maxillary, much more than the mandibular, dentition is usually involved in disturbances of growth or occlusion.

Some conception of the degree of variability between the sexes may be obtained from a comparison of the ranges which are given in the data according to sex. A greater range, suggesting higher variability, is generally perceptible in the males during the early years (2–5); after which the ranges in the females usually approach or even exceed those of the males. It will be recalled that in the graphs the males as a rule exhibited greater fluctuation in average growth than did the females, intimating therewith a higher variability in the former. Anatomical characters in general are considered more mobile in the male than in the female.

DISCUSSION

The preceding data, it is hoped, have helped clarify the modes of growth in the alveolar arches and its effects on form. Actually, the material available limited the inquiry almost entirely to consideration of the arches represented by the deciduous dentition. A sound knowledge, however, of the growth process in the deciduous arch is of peculiar importance to the orthodontist, for, in the words of Brash[4] (p. 77), "it is in the transition from one to the other [deciduous dentition to the permanent], that the most striking abnormalities and anomalies make themselves evident." The technic which we employed for analyzing the changes in form by the use of the various indices, in the deciduous dentition, might well be applied to a study of the arches of the permanent dentition. By thus comprehensively following the changes in dimensions and form of the alveolar arches from deciduous to permanent dentitions may the etiologic factors concerned in malocclusion be apprehended.* A word should perhaps be said with respect to the small amounts of annual growth noted in the arches. It must be remembered that the alveolar arch at its maximum size is a comparatively small structure, and the total absolute increment will necessarily therefore be limited. The percentage of growth in the arches, nevertheless, represents a fairly respectable amount; an increment of one millimeter in the width at 2 years is more than 2 per cent, and in total length it is more than 3 per cent. What is of greater import is the fact that the dental mechanism is such a delicate one that one millimeter may be the difference between proper and improper occlusion.

The problem of occlusion as influenced by growth in the alveolar arches is a complex subject which will be the subject of a detailed report subsequently. Some important implications, however, of direct interest to the orthodontist, we believe have resulted from the present inquiry. Varying

*Brash[5] clearly states this viewpoint.

rates of growth were shown, as indeed other investigators have done, to occur at different ages in the alveolar arches. This immediately must suggest to the orthodontist the necessity for caution in the use of space retainers or other mechanical appliances during certain age intervals, and especially at certain sections of the arches, in order not to interfere with the normal processes of growth. As a matter of fact, one of us has had the opportunity of observing over a period of years certain cases with complicated malocclusion which improved radically with no treatment whatever, whereas the space retainer ordinarily employed under the circumstances would very likely have actually prevented the beneficial changes noted. On the other hand, it is well known that good morphologic occlusion at an early age may degenerate later into malocclusion.

The orthodontist, moreover, is usually concerned with adjustments in particular parts of the arches. The method employed in the present inquiry, of considering growth in detailed sections of the alveolar arches, may therefore serve to good purpose. At the same time, the fundamental fact that the alveolar arch is essentially a single segment, and that a change in growth in one of its parts will usually affect the whole in proportion and form, must always be borne in mind.

Of interest to the orthodontist will probably be the tendency toward greater variability, or instability, of growth in the alveolar arches of the males as compared with that of the females, as well as the trend for variability, especially in form, to increase with age. The differences in mode of growth between the maxillary and mandibular arches are surely suggestive, but probably should not be stressed until the effects on occlusion are investigated.

The present study, like all its predecessors of similar content, has dealt with *average* growth, and is to this extent of limited value. Orthodontics especially is a field wherein consideration of the individual is paramount. The logical and only method of attack upon this problem of individual growth, it appears, is to follow throughout a long span of time the process of growth in each child of a representative group of children. Such a project, in fact, has been in progress under the direction of one of us for the past four years. But, as intimated, the results of a research of this kind would necessarily not be forthcoming for many years. In the meantime studies based on large and representative groups should prove valuable in revealing trends and stimulating further and more comprehensive investigations. By such efforts may a scientific foundation be laid for the practice of the art of orthodontics.

The dental impressions were taken by members of the staff of the College of Dentistry of New York University. Their services for the most part were generously contributed gratis, for which thanks and appreciation are here extended. Miss Mary Lawlor made most of the orthographic projections and measurements thereon, as well as aiding considerably with the computations.

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MOSQUITOES, ACIDOPHILUS, AND CARIES

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EVERY form of life seeks that environment which is most favorable to the continuity of its existence. We do not look for mosquitoes in dry and sandy deserts; but in stagnant, watery marshes we will find them. Do we believe because there are millions of mosquitoes in these marshes that the mosquitoes broke the rocks, dammed the streams, and thus created stagnant pools? Can we think that these stagnant waters created the larvae from which mosquitoes grew? Even though the mosquitoes did not the marshes make, nor the stagnant waters create the mosquitoes, we know that marshlands are the environments most favorable for the existence and continuity of this form of life. Just to the extent of the size of the marshland will it be possible for larger numbers of mosquitoes to be carried by favorable conditions far from their homes.

While we are willing to exonerate the mosquitoes of creating the marshlands, and the marshlands of creating the larvae, still we are sufficiently intelligent to employ both spade and shovel to fill in these stagnant swamps. We thus change the conditions of these places so that they can no longer serve mosquitoes as the necessary environments for their development and growth. By this sane and logical procedure we *prevent* the danger of mosquitoes *in* or near our homes.

The ***Bacilli acidophilus*** are no different from other forms of life. They also seek the environment most favorable for their continuity. They need carbohydrates with moisture and warmth, and preferably to remain undisturbed. Their best work is done in dark and secret chambers, far from the maddening, hustling crowd. No hurrying or fast moving dry carbohydrates do they desire, nor are larger spheres of rapid transmigrations the conditions best fitted for their life.

What more perfect and secluded environment can exist for the safety and proliferation of the ***Bacillus acidophilus*** than the quiet stagnant pools of warm and moist carbohydrates found at the bottom of precarious pits and fissures? Here they hide in safety, free from every worry, while nourishment is supplied to satisfy their needs. Their arch-enemy the *toothbrush* they now can defy, and for Fletcherizing mastication they have no fear. In their undisturbed and *undisturable* retreat they live, grow, and multiply.

Just as the marshlands do not mosquitoes make, nor mosquitoes create the stagnant pools, so pre-carious pits and fissures do not create the acidophilus, nor the acidophilus make the stagnant pools of food débris. If there are no carbohydrates in these tiny little caves, the walls will endure for many ages. But the carbohydrates are already there, with temperature and moisture just right. So the acidophilus bacillus busily produces the acid which breaks down the

substance of these caves. Unseen and unobservable by clinical observations, the progress of destruction will still go on. As the insides of these caves grow larger, their tops and sides fall in and then there looms before us large carious cavities more difficult to repair, and, for the patient, pain and greater cost.

As we do not look for mosquitoes in dry and sandy deserts, we do not expect to find *Bacilli acidophilus* in mouths with no decay, nor will they long linger where there are no desirable locations in which to live and multiply. To the extent of the enlargement of these favorable environments for the life and proliferation of these tiny bacilli, just to that degree may we expect to find them elsewhere within the limits of our bodies. While we are willing to exonerate the acidophilus of creating pits and fissures, and the pits and fissures of creating food débris, the wise and expert dentist having confidence in his organized profession will comply and cooperate with the official recommendation to fill all pre-carious holes, faults and flaws. This sane and safe procedure so simple to perform, will *prevent* the creation of warm and stagnant pools of materials so necessary and attractive for acid-producing bacteria which destroy the teeth. When every dentist does this, then will all the children sing: *Who's Afraid of the Wee Bad Acidophilus?*

DENTISTRY AND PUBLIC HEALTH*

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Supervisor of Mouth Hygiene, State Department of Health

THE modern profession of dentistry has a distinct contribution to make to your life in comfort, health, and efficiency. It is a young profession. As a branch of medical science it is less than a century old. The first dental school in the United States was established about 1839. The first use of x-ray pictures in dental surgery was made by Dr. Edmund Kells of New Orleans in 1896. In the early days when Dr. Kells began his work with x-ray no thought was given to the necessity for precautions to safeguard the operator from burns. In his experimenting, Dr. Kells lost one finger, then another, finally a hand, and then an arm. He died a few years ago, a martyr to the cause of his experimental work as a pioneer in dental x-ray photography.

Truly the modern world owes a distinct debt to men like Dr. Kells who have brought dentistry such a long way in a comparatively short period. Perhaps when contemplating a visit to the dentist, we do not appreciate our advantages in skilled operators trained by years of study, in cleanliness, and convenience of the modern dental office, in the use of scientific equipment which diminishes or eliminates pain and which facilitates diagnosis. Suppose you were to go into a dentist's office and find it equipped as dental offices were in the Middle Ages. Then dentistry was commonly practiced by barbers; in the American colonies, by goldsmiths, jewelers, umbrella makers, blacksmiths, wig-makers, tinkers, and itinerant Jacks-of-all-trades. George Washington's dentist (John Greenwood) was a skilled mechanic and maker of cabinets and mathematical instruments. Paul Revere, in addition to his work as goldsmith, was a dentist, a maker of plates and false teeth.

All known peoples have been interested in and have realized something of the importance of teeth. As a measure of the early Hebrews' evaluation, we have the record of a law that required a master if he "smite his man-servant's tooth, or his maid-servant's tooth, he shall let him go free for his tooth's sake." Beauty in all parts of the world is recognized to depend to some degree upon the appearance of the teeth. True, the standard of beauty of some of the more primitive peoples seems strange to us; e.g., the mutilation of teeth by filing, as is the custom of the Indians of Central and South America. From the earliest times definite attempts have been made to preserve and whiten teeth. Small pointed instruments supposed to have been used for toothpicks (the forerunner of the toothbrush) have been found in many ancient tombs. The Greeks and Romans used cleansing powders made of pumice, alabaster stone, coral powder, or bones of certain animals, or shells burnt, mixed with honey, and reduced to a fine powder.

*A radio talk.

Dental decay was not widely prevalent among uncivilized races. I recall hearing a dentist tell about some field investigations he had made among the Eskimos. He said that when the Eskimo lived isolated from the settlements of the white man, his teeth were excellent. Mrs. Eskimo chews the animal skins to soften them before making shoes and thus wears her teeth down very close to the gums, but usually they do not decay. Among those Eskimos who are within a day's journey of the trading post where they buy white sugar and other refined foods of the white man, decay of the teeth increased from a few teeth per thousand to several hundred teeth per thousand of those examined. In this country decayed teeth are known to almost every one. It is a rare exception when one finds an adult with no filled or decayed teeth.

On the evening of March 27, 1934, 1,500 members of the dental and medical professions gathered in New York City eager to hear five eminent dentists and a biochemist present their views on the question, "Resolved: That a clean tooth does not decay." It was a debate in which all seem to have won. These scientists seem to be agreed that the undisturbed retention of bacteria and food débris is absolutely essential for the beginning of decay. They are further agreed that this retention is easiest in poorly formed teeth, in deep fissures, and in pits. They believe that poorly formed teeth are the result of faulty diet during the developmental period. One of the hearers of the debate summed it up in a mathematical equation which covers at least a part of the causes of dental decay. He says that bacteria plus dietary deficiencies plus mouth cleanliness plus physical discrepancies equal cavities.

Approximately 500,000 white children have enrolled in the schools of Georgia during the month of September. Dental inspections of more than 200,000 of these children show a great need for mouth hygiene as a health measure. Mouth infection is the most universally prevalent disease or health defect among our school children. No other defect approaches it in its almost unfailing presence. Teachers, parents, and children do not realize the serious effects which these diseased conditions may produce in the body. Even if the teeth were merely biting and chewing devices and limited in their effects to the mouth, such findings should cause concern. But scientific research and medical experiences have shown the relationship of teeth and general health indicating that diseased teeth are a serious menace to health. This being the case, parents cannot help but be anxious about the mouth health of all members of the family, particularly children. Indeed, the situation calls for intelligent study and consideration. What can we do to limit and prevent dental disease? Dr. Walter McFall, professor of children's dentistry at the Atlanta Southern Dental College, in answer to the question, "Can decay of the teeth be prevented" says:

"Decay of the teeth not only can be prevented but is being prevented daily.

"There is no magical mysterious short cut to this glorious good health. The greatest philosopher of your day and mine cannot philosophize away the toothache. No medicine or preparation sold in a jar, tube, box, can, or bottle will prevent your teeth from the ravages of tooth decay. No single factor will do the job to everyone's satisfaction, and no individual or organization can guarantee you against the scores of decaying teeth.

"But the picture is far from hopeless and helpless; the remedy is fairly simple. It concerns mainly the most important person in your life, you. A method of preventing decay of the teeth rests almost entirely with you and your dentist. Strong, healthy, useful teeth are the result of (1) good nutrition; (2) adequate home care of the mouth and teeth; (3) regular early and systematic visits to the dentist."

The Georgia State Board of Health has an important duty in educating children and parents as to the value of teeth, temporary as well as the permanent set; to the knowledge of foods that build good teeth; to the effects of bad teeth on the general health; and to the proper hygienic care of the mouth which includes the correction of the slightest defect by the dentist. Dr. Abercrombie, state commissioner of health, appreciates the fact that the dentists have contributed so much to the school health program. "No public health program," says Dr. Abercrombie, "would be complete without an adequate dental health project actively supported by the dental profession." The State Department of Education recognizes health as a fundamental aim of education, and educators have called upon organized dentistry to help in this important program of health protection, correction, and instruction. Our schools represent a large group of individuals with plastic minds who are in a position to receive the message of mouth hygiene. Thousands of grown-ups wish today that schools had had this particular enthusiasm twenty years ago.

The plea that comes to you today from the Georgia State Board of Health is: Follow the advice of modern dentistry.

1. Include in your diet those foods that build strong teeth and protect against tooth decay and other mouth diseases. They are milk and other dairy products, vegetables, especially green leafy vegetables, and fresh fruits. In addition, sunlight and cod liver oil are needed by the growing child.

2. Visit your dentist twice a year for mouth examination and the necessary correction of defects. This means prevention as well as correction and preventive measures cause a minimum of trouble, pain and expense.

3. Cleanse the mouth properly at least twice daily.

We must never lose sight of the fact that dental care is health care. Good health depends upon good teeth and good teeth depend upon health.

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Treatment by Diet. By Dr. Clifford J. Barborka, 1934, Philadelphia, J. B. Lippincott Company.

From the abundance of scientific material which is available today with regard to diet, the author has for this presentation selected the elementary principles and has purposely omitted excessive details.

The first chapter of the book deals with diet in health and with those essential requirements that every satisfactory diet must possess, namely, adequate protein, mineral elements, vitamins, sufficient calories for energy requirement, and water. A few introductory remarks are made on the evolution of our diet and the different eating habits which the various people have developed. "Custom determines the arrangement of the meals and kinds of foods eaten, but the experience of the race governs the custom." The American diet includes a large amount of sugar and sugar products, which make up more than one-fifth of the whole daily energy requirement without supplying any vitamins. A large percentage of the remaining food has lost its vitamin potency in the refining process. Less meat is being consumed now than formerly. This renders the diet high in carbohydrates and acid minerals, low in vitamin and alkaline minerals ("protective foods"). A diet low in "protective foods" makes the individual subject to early degenerative diseases. Furthermore, diet has a direct bearing on one's nature and if allowed to remain unbalanced through years and generations, may affect the physical and mental characteristics of whole races.

Treatment by diet may be applied in two ways: by the prescription of a qualitative diet (restriction or omission of certain foods) or of a quantitative diet (total quantity of each food is regulated). For this latter group, a method of calculating the different foods is presented which eliminates guesswork, even for the housewife, by supplanting gram weights with household measures. By means of simple tables and illustrations, comparative surveys of cereals, breadstuffs, dairy products, meats, vegetables, and fruits are shown.

The next part of the book deals with diets in disease. It is subdivided into two main chapters, one of which discusses those diseases in which diet is of paramount importance, namely, metabolic diseases (diabetes mellitus, gout, overweight, underweight); diseases of the digestive tract (peptic ulcer, constipation); deficiency diseases (xerophthalmia—lack of vitamin A; beriberi—lack of vitamin B; scurvy—lack of vitamin C; rickets—lack of vitamin D; pellagra—lack of vitamin G; tetany and osteomalacia; simple goiter, iodine deficiency). The other subdivision deals with conditions in which the diet is

of varying importance. Here belong diseases of the heart, the stomach, the liver, the intestines, skin diseases, pregnancy, lactation, and dental caries. The factors influencing dental caries are listed as:

(1) Environmental factors (oral hygiene, microorganisms, carbohydrate, saliva).
(2) Nutritional factors (carbohydrate, acid-base balance, mineral, vitamin).
(3) Heredity.

A diagram is here reproduced (Fig. 1) in order to illustrate how the modern physician presents his views upon the etiology of dental caries.

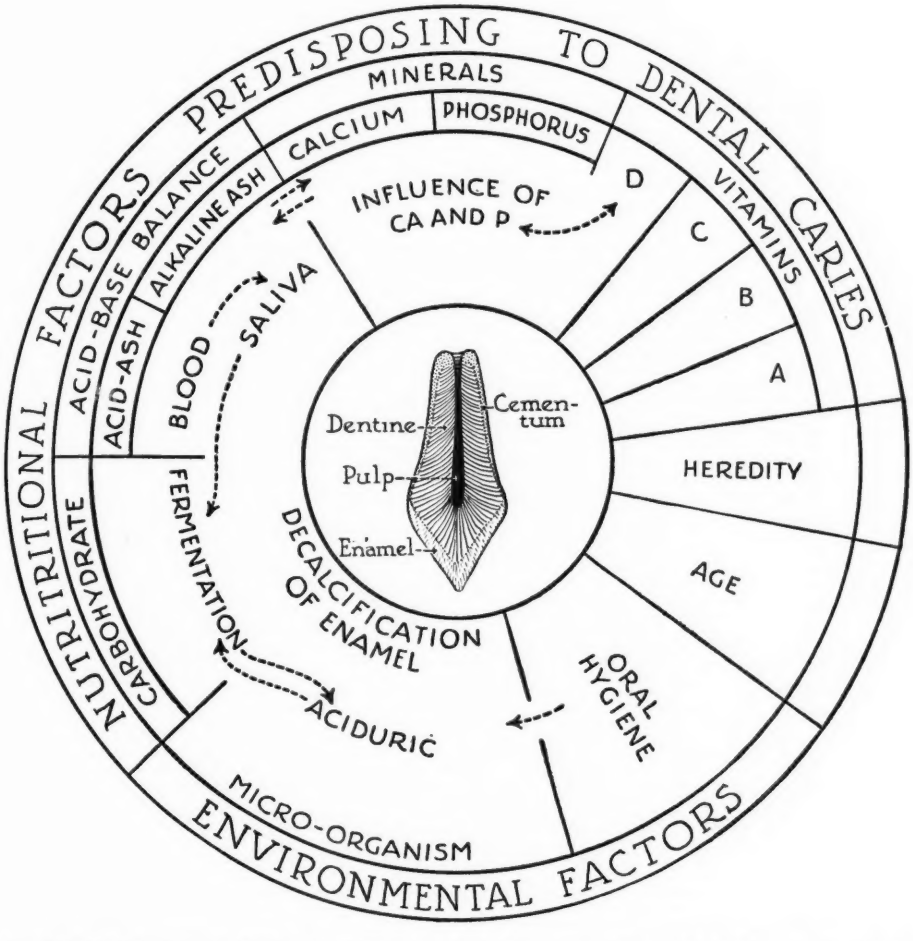

Fig. 1.—Important factors that may influence dental caries. (Copyrighted by J. B. Lippincott Co.)

In the beginning of the book the author states that, "Coincident with this advance which has developed a more thorough appreciation of the use of properly selected foods in the promotion of health, the food fakirs, faddists and pseudoscientists, picking out an occasional truth, distort it and broadcast to the unsuspecting public a tremendous volume of misinformation." Nothing better can be said about his presentation than that he has fully kept his promise in the midst of a field from which many byways are liable to lure the wanderer away upon sidetracks. His conclusions are based upon careful investi-

gations and on extensive clinical experience, and the various disputed questions are discussed in a conservative and unbiased manner. One cannot but admire the author for this attitude. The orthodontist, who believes in advising his patients about diet, will find in this volume a reliable and a practical guide.

E. N.

The Antiseptic Action of Saliva. Translated and abstracted from "Die antibakterielle Funktion des Speichels" by Dr. Hermann Dold. Deutsche Zahnärztliche Wchnschr., September, 1934.

The antiseptic action of the saliva can be noticed from the fact that the mouth of a healthy person contains only a limited number of bacteria and that these bacteria do not keep on multiplying indefinitely. More specific data were obtained through the following experiments.

A suspension of bacteria was made in a physiologic salt solution and added to an agar plate. Colonies of bacteria were distinctly visible twenty-four hours after the agar plate was placed in the incubator. On the other hand, when human saliva (which is also a suspension of bacteria) was used, no change took place in the incubator after twenty-four hours; colonies of bacteria appeared only after three or four days. The saliva gradually loses this bacteria-inhibiting quality if allowed to stand for a longer period of time. A similar inhibition of bacterial growth can be demonstrated by adding staphylococci to a mixture of agar and saliva (equal parts). This mixture may be heated up to 50° C., without any growth of staphylococci occurring in the incubator. However, if the saliva is heated to 56° instead of 50°, its bacteria-inhibiting quality is lost.

In order to be effective, the saliva also needs a certain concentration on the saliva-agar plate. Diphtheria bacilli were placed on a saliva-agar plate in such concentration that there was not quite enough saliva to inhibit the growth of the bacilli. The developing colonies were transferred to new saliva-agar plates. After several transfers, it was noted that the diphtheria bacilli had changed to the pseudodiphtheria type. By growing these latter on pure agar plates (without saliva content) they could again be converted into true diphtheria bacilli. However, after being grown for an extended period on saliva-agar plates, they finally lost their true diphtheria characteristics and could not revert again. This may be called the mutating quality of the saliva.

Besides the inhibiting and the mutating qualities of the saliva, it was also found that it contained germicidal substances which were able to kill diphtheria bacilli outright.

The antiseptic action of the saliva probably depends upon these inhibiting, mutating, and germicidal qualities. This explains the fact that certain animals are immune to infection through nose and throat, while vulnerable to the same bacteria at other locations. A new explanation of the instinctive licking of wounds on the part of some animals may be found in this light.

E. N.

The Forum

Articles for this department should be sent to Dr. Albert H. Ketcham and Dr. William R. Humphrey, 1232 Republic Bldg., Denver, Colo.

A Biochemical Hypothesis for Bone and Tooth Resorption

It is well recognized that bone does not consist merely of inert lifeless masses of substance, unlikely to be disturbed or altered after formation. On the contrary, all the mineral substances are constantly involved in the endless exchange of inorganic salts which occurs between the circulatory fluids, the bone and other tissues and organs. It is apparent, therefore, that the optimal intake of one gram of calcium must be followed through all the various metabolic changes before the complete explanation of calcium utilization can be made.

The biochemistry of bone and tooth formation is based upon the study of the following factors: first, an adequate supply of minerals usually in the form of organic substances such as the calcium caseinates; second, the degree of concentration of hydrogen ions in blood plasma and intestinal contents; third, the calcium content of the blood and the proportions existing between the four types of compounds, such as the ionizable and non-ionizable, the dialyzable and non-dialyzable substances; fourth, the blood phosphates; fifth, the amount of parathormone; sixth, the activity of the thyroid gland.

In addition to these various general factors, of as yet undetermined relative importance, there are the local tissue reactions to be considered. Both Kay and Bodansky have studied the phenomena of calcification in actively growing bone. During this period it has been demonstrated that an enzyme, phosphatase, is present in calcifying cartilage. This catalytic agent accelerates a precipitation of the hexose phosphates carried to the bone matrix in the blood. Since it has been demonstrated that certain enzymes may under some conditions hasten the speed of a reaction in either direction, it is possible that phosphatase may be partly concerned in the reverse process of calcification, namely, resorption.

It is suggested that root resorption demonstrated experimentally in monkeys and observed in patients may occur in the following manner. The slightest pressure on roots produces a localized hyperemia both of peridental membrane and of pulp. This probably is the first stage in resorption. Partly as the result of trauma from pressure or other source the phosphatase instead of aiding in the *precipitation* of phosphates, now presumably effects *solution* of the lime salts. It is not apparent where the osteoclast influences the process. This multinucleated giant cell has been described as a modified osteoblast, the modification being of function rather than morphology. However, Wells

suggested in 1914 that cells in an area of active *calcification* might conceivably raise also the pH of the matrix fluid. Such an increase in alkalinity is favorable for the deposition of lime salts.

Tentatively applying this idea further, would it not be logical to assume that *decalcification* is a part of phosphatase action, but in the reverse direction; furthermore, that it is aided by the secretion of a fluid of lower pH, that is of greater acidity? It is admitted that the basis for this hypothesis has scant support of experimental evidence; on the other hand there is no contrary evidence. The suggestion is logical and accounts in part for the hyperemic conditions found in areas of resorption. Further research on this problem will, however, be necessary before more definite conclusions can be drawn.

John Albert Marshall

Enlightening the Parent

A college student once attempted to explain the workings of a linotype machine in a ten-minute address before his class in public speaking. He was thoroughly familiar with his subject, his audience was attentive and eager to be cooperative; yet the result was amusing, pathetic, and above all, embarrassing. He was handicapped by an extensive knowledge of his highly technical subject. He found it impossible to eliminate numerous details which were important to him but meaningless to his audience, and failed to mention the fundamental and (to him) obvious principles involved.

As orthodontists we frequently find ourselves called upon to perform a similar task, and too often we perform it with a similar result. When we discuss our problems with members of our own profession, we may do so with comparative ease, but to discuss the same problems with the parents of a prospective patient is another matter. We have a highly technical, often controversial, subject to present; and if we wish to secure the cooperation of patient and parent and teach them the true value and meaning of orthodontia, we must present the subject clearly, concisely, and simply. In the discussion of controversial subjects a question of ethical procedure often arises. Are we justified in presenting to the parent, as facts, statements which have not been proved and which we would hesitate to make before a group of orthodontists, or should we express our doubts, which will invariably be interpreted as ignorance? Such matters play an important part in the successes and failures of our practices and deserve intelligent thought and reflection.

Although it may not be the policy of the Forum to review current publications, it seems worth while to call the attention of orthodontists to a discussion of orthodontic problems written for the lay reader which appeared in the March issue of *Hygeia*. Both *Hygeia* and the author, Dr. David W. McLean, are to be commended for this article, entitled "Keeping a Straight Face—and Straight Teeth." It is written clearly and simply and, although some of the statements may be open to question by members of our profession,

is an excellent example of the way in which some of our problems of explanation may be handled. It should be valuable to the orthodontist both for his own information and as an addition to the reading material of his reception room.

Charles M. Waldo.

Excerpts From a Paper Entitled "The Orthodontic Problem and Its Relation to Dentistry"*

A generation ago the general practitioner was all inclusive so far as the dental armament was concerned. A change in this status, however, came with an increased knowledge in certain fields, the result of which brought the dental specialties into being; and since that time there has been a growing diversity of practice, with certain well-defined boundaries being established between the general practitioner and those devoting their energies to specialized endeavor.

The object of dentistry, as a whole, is to establish and maintain the oral structures in a state of health so that they can best serve the needs of the whole organism. The general practitioner is chiefly confronted with restoring and maintaining dental functional relations, combating dental caries and its sequelae, supplying artificial substitutes for missing dental organs, treating gingival infections, and preventing or relieving periodontal diseases. This task is of sufficient magnitude to occupy the abilities of the best-qualified men and women.

No specialty develops spontaneously but evolves slowly as the result of circumstances which create the necessity for it. Whether it be orthodontics, oral surgery, periodontia, prosthetics, or any other well-defined field, specialization has brought these branches to a degree of excellence never approached when combined with the many exacting demands of general practice. This growing diversity of endeavor has had the effect of dividing responsibility, for no practitioner is possessed of a sufficient breadth of knowledge to cover the whole field. The question of when and where to recognize one's limitations becomes, therefore, an important moral issue, the settlement of which must rest within one's own conscience.

"Orthodontics may be defined as that science which has for its object the prevention and correction of dental and oral anomalies." Basically, it must consider, therefore, the etiology of such conditions; and when manifest, determine by dependable diagnostic methods, their nature, location and extent; and endeavor, through suitable precedures of treatment, to restore the affected parts to normal form and function.

Such deviations from the normal may include any one of or all the structures in the oral ensemble, may be simple or complex or register varying degrees between these two extremes. For example, one or several adjacent or opposing teeth may be malaligned and thereby be deprived of normal func-

*Read before the Rocky Mountain Mid-Winter Clinic of the Denver Dental Association, January 10, 1935.

tion; or groups of teeth in one or both dental arches may contribute to the anomaly, involving their immediate alveolar structures; opposing dental arches may be malformed and malrelated unilaterally or bilaterally; in still other instances the maxilla or the mandible, or both, as well as their adjacent facial structures, may be included in the deformity. In addition, there may be such miscellaneous deformities as those resulting from maxillary cleft, abnormalities of dentition manifest as anomalies of form, of number, and of eruption, groups of deficient or malfunctioning muscles, and abnormal developments of the tongue. It should be obvious, therefore, that the term "malocclusion" (or malclosure of the teeth) inadequately describes the varying conditions and relations manifest in dental and oral anomalies unless its meaning be extended to include a far greater range of pathologic entities.

A realization of the varied nature of the problem and the many factors to be considered has altered our concept materially during the past decade. No longer do we think of mechanical appliances as being the open sesame for the relief of such conditions. In spite of the noticeable advances in the means available for bringing about tooth movements and other needed anatomical alterations, such agencies are inadequate unless used in a manner to augment inherent possibilities within the structures themselves.

Dental and oral anomalies represent conditions wherein aberrations of growth and function are manifest. The extent of their development represents the degree to which normal processes have been interfered with or inhibited, and depends largely upon the life period when such influences were made effective. When not subjected to such inhibiting factors, the masticatory apparatus and its related parts, from their earliest rudimentary formation, undergo progressive changes which make possible at maturity the completed system of organs which we may call the oral ensemble. The manner in which these changes occur, their sequence, and the laws under which they operate become, therefore, a matter of first importance to the practitioner. Such knowledge is the first requisite to an understanding of both the normal and the abnormal.

With this responsibility confronting us, we are forced to discard some of the empiric dogmas of the past and to seek aid in those fields of science utilized by medical orthopedists, for their problems and those of the orthodontist run in parallel channels. In other words, a knowledge of growing changing structures, of normal function and the effects of perverted function, of nutrition and malnutrition, must play an important rôle if success is to be attained.

In studying the responsibilities of the general practitioner and the orthodontist, we realize that, to a certain extent, each is separate and distinct, although merging in certain instances into a joint relationship. Each should be equally interested in the welfare of the child, and each should keep the other informed so that both may have the true concept of modern dentistry as a whole.

The general practitioner is the first to come in contact with the child patient and, therefore, should be keenly alert to any early symptoms which would indicate a developing anomaly. During the eruptive period, every

malaligned tooth or slight variation of the denture does not necessarily mean the onset of conditions which must receive orthodontic treatment, for certain manifestations in the denture which sometimes give alarm are frequently but phases of development. The important thing is to know the true danger signs and those which are benign in character.

In cases in which the deciduous teeth only are present and treatment measures are indicated, it is wrong to claim that such steps will preclude the necessity for treatment at later periods. Much propaganda has been broadcast along this line but is not justified by the real facts. Early intervention may mean much to such patients, but a variety of new conditions may have to be met later, depending upon individual factors in different children.

Reference has been made to the fact that the general practitioner is the first to come in contact with the child patient and, therefore, should be keenly alert to any symptoms which would indicate an anomaly. In those instances in which the dental and oral structures show definitely that anomalies are developing, an early diagnosis is most essential. There is a distinct difference between detecting an anomaly and making a diagnosis. In other words, one may detect a developing anomaly and realize the necessity for orthodontic intervention without actually making a diagnosis. This is where the general practitioner and the orthodontist may cooperate to the decided advantage of those patients coming under their care.

"Orthodontic diagnosis comprises all methods essential to determining the nature and extent of anomalies affecting the oral ensemble." If it is to point the way to intelligent treatment, it must reveal the character and degree of any abnormality present. The purpose of such a quest is not to determine mere gross generalities, but to reveal the part or parts of the oral ensemble which are abnormal, the character of deviations manifest, and the approximate extent of each involvement. To make such a survey with accuracy, each case should be recorded with suitable denture and facial reproductions, which should be supplemented with roentgenograms of the dental and oral field. Denture reproductions, or dental plaster casts as they are more frequently called, should be made in such a manner that the orientation of the denture to its dependent facial structures is revealed. Facial reproductions, whether they be obtained from the use of the photostatic clinical camera or otherwise, should be made in a definite ratio of life size, showing the interrelations of the jaws as well as their cranial relationship and should reveal, so far as possible, the correlation between the denture and the face. With such records before him, the practitioner may then note the occlusion of the teeth; the form and relationship of opposing dental arches; whether or not the anomaly extends beyond the immediate area of the teeth and includes the alveolar portion of the jaws; or beyond these boundaries and involves the maxilla or mandible, or both; in case of the mandible, whether the body or the rami are involved, and if so, to what extent each contributes. These records should be supplemented by a thorough intraoral and extraoral study of the musculature of the face and of the tongue so that any abnormalities of these structures may be noted. In other words, every part of the oral

ensemble affected by or contributing to the anomaly should be differentiated. In establishing a basis for comparison between conditions as recorded and those which may reasonably be considered the normal, the average usually encountered under normal conditions may be used as a criterion. Following this, a finer differentiation should be made when determining the needs of treatment by considering each case upon the basis of its individual typal requirements. Only when this point has been reached is the practitioner in a position skillfully to direct his efforts in the field of treatment. In view of these requirements, it is a source of wonder that we still read, in some of the journals, of laboratories offering to provide appliances for the correction of "so-called malocclusions," and include with such paraphernalia "full treatment instructions." Such offers might have been justified during the "tinsmith age" of orthodontics, but in 1935 they are outlawed and should be considered on an equal basis with other rackets. In my opinion, not only are such methods unethical, but also dentists using them should be considered guilty of malpractice. Most state laws require that a dentist "utilize ordinary care and skill," which has been defined as "that degree of care and skill customarily used by the ordinarily careful members of his profession." He is obliged to keep abreast of the times and is not excused if he departs from approved methods in current use. Liability is judged by the status of knowledge and skill current in the profession at the time treatment is rendered. Even during the dark ages of orthodontics "mail order practice" was not considered justified by those possessing even an average knowledge of the subject. God speed the day when such examples of avarice and ignorance shall cease to be.

James David McCoy.

Dentistry and Orthodontia?

An editorial appearing in the February issue of *Dental Items of Interest* entitled "The Relationship Between the Specialty of Orthodontia and the General Practice of Dentistry" should create discussion among orthodontists as well as among dentists in general practice.

The editorial opens by speaking of the advent of the late Dr. Edward H. Angle and the Angle School of Orthodontists and with the pronouncement that the specialists in orthodontia should be exclusive specialists and should abandon the practice of general dentistry. The editorial then recites the experience of the writer in practicing orthodontia and dentistry conjointly. Quoting from his experience:

"The writer, having undertaken to practice orthodontia and dentistry conjointly, it happened that his practice of orthodontia grew rapidly, and the time came in a few years, when he discovered that the practice of dentistry is incompatible with the care of any considerable number of orthodontic patients.

"The reason why the orthodontic part of a mixed practice will increase numerically very rapidly, if one undertakes to completely correct all types

of malocclusion, as do the exclusive specialists, is the length of time which must be devoted to each patient, probably five, or more, years. Thus, if a practitioner should acquire five new patients per year, at the end of the fifth year he would be giving appointments to twenty-five patients.

"The present writer, in the course of time, found himself endeavoring to care for something like forty orthodontic patients. With the morning hours reserved for general dentistry, he finally discovered that he could not care for the construction of new appliances, and the constant demands for emergency repairs. Wisely (or otherwise), he placed his orthodontic patients into other hands, and thenceforth devoted himself exclusively to general practice."

The editorial also discusses compromise treatment, which is defined as being the correction of visible malpositions and at the same time produces a functional occlusion:

"We have the specialty of oral surgery, for example, but the general practitioner has not abandoned this field entirely. The dentist will refer his patient to the surgeon for the removal of impacted third molars, but he does not require the exodontist for the extraction of deciduous teeth. In other words, the dentist retains the right to practice surgery, being, in fact, a D.D.S., Doctor of Dental Surgery. But the conscientious dentist limits his surgery to cases which he feels entirely competent to care for. The dentist should follow a similar course in relation to orthodontic treatment; for persons who cannot pay the fees of the exclusive specialist, he should supply 'compromise treatment.'

"What does this mean? The exclusive specialist undertakes to fully correct malocclusion, moving all teeth as nearly as possible into normal occlusion. In compromise treatments, the dentist may feel that he has rendered a worthwhile service if he corrects the visible malpositions, and at the same time, produces a functional occlusion."

The editorial closes by calling attention to the formation of the North Atlantic Orthodontic Society: "This, however, is not a society of orthodontists, but rather an association of dentists, banded together for the study and practice of orthodontia, as a part of dental practice." Its aims and purposes are stated to be as follows:

"1. To encourage and foster the development of the study of orthodontia, in the general practice of dentistry.

"2. To disseminate accurate information as to all matters of interest to the association and the membership thereof.

"3. To advance the art and science of orthodontia in all of its phases.

"4. To promote a more enlarged and friendly intercourse between orthodontists and the members of the dental profession generally.

"5. To discourage the divorcement of the science and art of orthodontia from the profession of dentistry.

"6. To encourage the contribution of the science and art of orthodontia in the interest of public health.

"7. To cooperate with dental organizations, societies, and associations by lectures and meetings for the purpose of enhancing the progress of the science and art of orthodontia."

The formation of such a society may be a forward step, but such a society will not solve the problem of giving more patients good orthodontic treatment. Will not the members of such a society, after beginning to practice orthodontia and general dentistry conjointly, find themselves in the same position as the writer of the editorial who wisely or unwisely turned his orthodontic cases over to some one in exclusive practice?

The solution of the problem lies in the better education of a larger number of orthodontists to engage in exclusive practice.

A skillful orthodontist is likely to view the compromise treatment of orthodontic cases employed by most general practitioners as a competent dentist views the efforts of an incompetent operator in gold foil, inlays, and prosthetics.

There was a period in our development when an orthodontist in exclusive practice could not be reached by patients in many communities. This condition is rapidly changing, and many of the smaller cities have orthodontists in exclusive practice, and in a great many instances these men are members of the American Society of Orthodontists.

The question of economics as well as the question of service rendered enters into this problem, viz.: Shall the not too busy general practitioner endeavor to treat malocclusions of the teeth and assume the risk of indifferent results, or shall he refer these cases to the not too busy orthodontist, who can secure normal occlusion of the teeth and for as moderate a fee as the general practitioner?

W. R. H.

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Editorials

Action of the Board of Trustees of the American Dental Association

AT THE recent meeting of the Board of Trustees of the American Dental Association a resolution was adopted in regard to the program of public health which links the dental profession closely to the medical profession in its action pertaining to the subject. The following measures were adopted by the Board of Trustees at the meeting:

"The Board of Trustees of the American Dental Association believes that the enactment of a program of compulsory health insurance administered by the Federal Government, the government of the individual states, or by any individual industry, community, or similar body, would inevitably lead to the regimentation and lay control of dental practice which would not be in the

interest of the public. That a lowering of the standards of dental practice would result, is indicated by the evidence from compulsory health insurance legislation in the European countries where it has been in operation for some years, where it has not only failed to accomplish the measure of alleviation expected of it but also has seriously impeded practitioners of the healing arts in the performance of their duties and has been a barrier to the further scientific development of the professions. The Board of Trustees commends the House of Delegates of the American Medical Association and approves the action pertaining to compulsory health insurance taken at its meeting, February 16, 1935."

Herbert A. Pullen

ORTHODONTIA has again suffered the loss of one of its grand old pioneers. Herbert Pullen passed away suddenly on February 17 in St. Petersburg, Florida, where he and Mrs. Pullen were enjoying a winter vacation. He had not been very well of late, but cards received later by some of his friends, written on the day of his death, indicated that he was feeling better and was in the full possession of his usual bright spirits.

Herbert Pullen was the son of an Episcopal minister. He was graduated from the University of Minnesota Dental Department in 1893 and spent six years in general practice. In 1899, accompanied by two or three friends, he spent some time with the late Dr. Edward H. Angle in St. Louis, when he took the early part of his postgraduate orthodontic training. During the following year when Dr. Angle conducted his first formal class, Dr. Pullen returned to assist as an instructor, as well as to take the full course himself.

Following this he moved to Buffalo and entered the practice of orthodontia exclusively. For eighteen years he was Professor of Orthodontia in the University of Buffalo, and resigned from that position only last fall. As a mark of honor for his faithful services, the faculty made him Professor Emeritus of the University.

During the past three decades he has belonged to that great group of men who have carried the progress of orthodontia over its stormiest course—the like of which will surely never be experienced again. It may indeed be said that the very survival as well as the progress of orthodontia was largely due to the fact that orthodontia had attracted the interest of men of the character and determination, and that indomitable will to win, among whom Herbert Pullen was foremost. Those who knew him best were well aware that the words "can't" and "stop" never entered his head. There was no task he was willing to tackle into which he did not put his whole heart, with full expectation of accomplishment.

For twenty-five years Dr. Pullen was in demand throughout this country and abroad to read papers and to give clinics. Audiences listened intently to his every word, and in the clinic rooms there were always crowds around his table. While he wrote many papers and textbooks for which he deserves full credit, it may be said that the designing of instruments, materials, and

methods of treatment was his forte. This was perhaps due to the fact that his early training was a strong influence toward mechanics, but the degree to which he developed it was the result of his own genius, the love of his work, and a sound scientific knowledge for a background. He designed pliers and instruments which have stood the test of years and probably will never be improved upon. All these he gave generously and with that characteristic smile of his. He was ever willing to go out of his way to give any fellow orthodontist, friend, or young man, the benefit of his lore of useful things.

Dr. Pullen was one of the founders of the American Society of Orthodontists, and the meeting to be held this spring will be but the second one to which he has not contributed in person. Even for this meeting he had planned to give a clinic on some new materials which he had never shown before. Throughout his career he was always active in organized dentistry, representing the perfect type of man who gave his energies unselfishly for the advancement of the highest standards of orthodontia with no motive for personal gain. In committee meetings, in council halls, and in debate, his opinions were always sought and respected. He was President of the American Society of Orthodontists in 1907, and the second President of the New York Society of Orthodontists in 1922. In 1927 at the annual meeting of the American Society of Orthodontists a banquet was held in honor of the Past Presidents; of the twenty-five, all were present or living. Dr. Pullen is the eighth one of this group who has gone to join his comrades on the other side.

It may truthfully be said that whatever the future structure of orthodontia presents, and however high it lifts itself, Herbert Pullen was among those who laid the foundations and did their work well. With his passing he has left humanity enriched by his life's work; and when histories of orthodontia are written in future years, his name will appear at the most vital period of its existence. It behooves the Old Guard to continue courageously on, reflecting his spirit on the younger men, so that they may emulate his ideals and labor on in the field he loved so well.

J. D. E.

News and Notes

American Society of Orthodontists

Thirty-Third Annual Meeting

New York City—April 30, May 1, 2, and 3

The thirty-third annual meeting of the American Society of Orthodontists will be held April 30 to May 3 inclusive at the Waldorf-Astoria Hotel, New York. The program committee has arranged an outstanding program.

The following orthodontists have made application for membership:

L. B. Higley
Irwin F. Stever
J. Lyndon Carman
Wm. M. Pugh
Herbert H. Ernst
Samuel P. Adams
C. S. Foster
Van A. Stilley
M. Bagley Walker
Charles F. Russell
Wm. Tyler Haynes
Chas. W. Bruner
Howard J. Buckner
Floyd E. Gibbin
John G. Brittain
Ray Woodworth
Harold E. Rice
Russell T. Goldsmith
Walter J. Sly

Railroad tickets for the meeting may be secured on the certificate plan, and the members accordingly will have the advantage of a fare and a third, provided as many as one hundred certificates are secured. All members and every one attending this meeting should be sure to take advantage of the certificate plan.

L. M. WAUGH, President,
576 Fifth Avenue,
New York, N. Y.

CLAUDE R. WOOD, Sec'y-Treas.,
Medical Arts Bldg.,
Knoxville, Tenn.

Program of American Society of Orthodontists
New York, April 30, May 1, 2, and 3

HOTEL HEADQUARTERS—WALDORF-ASTORIA

TUESDAY, APRIL 30, 1935

Morning Session

9:00 A.M. Registration.
9:00 A.M.—10:00 P.M. Scientific exhibit, Astor Gallery.
10:00 A.M. Invocation. By Willard P. Soper, D.D., New York.
Address of Welcome. By Frederic T. Murlless, Jr., Hartford, Conn.
Response. By Frank M. Casto, Cleveland, Ohio.

10:45 A.M. President's Address. By Leuman M. Waugh, New York, N. Y.

11:30 A.M. Executive session. Report of the Board of Censors. Report of the Program Committee.

11:45 A.M. Case reports: Four Open-Bite Cases, Their Etiology and Treatment. By George R. Moore, Ann Arbor, Mich.

12:15 P.M. Luncheon.

Afternoon Session

2:00 P.M. Paper: Integral Growth in the Face.

1. Nasal Area. By T. Wingate Todd (by invitation), Professor of Anatomy, Western Reserve University.

Discussion by Harry Neivert (by invitation), New York.

2. Dentofacial Area. By B. Holly Broadbent (by invitation), Anatomical Laboratory, Western Reserve University.

Discussion by C. C. Howard, Atlanta, Ga.

4:00 P.M. Case reports:

(1) The Report of the Treatment of a Rather Unusual Case of Neutroclusion.

(2) The Report of the Treatment of a Case of Extreme Overbite Where Mandibular Incisors Are Resting Distally to the Rugae. By Henry U. Barber, Jr., New York.

4:30 P.M. Executive session.

Evening Session

7:00 P.M. Informal dinner, devoted to the American Board of Orthodontia, New York Athletic Club.

WEDNESDAY, MAY 1, 1935

Morning Session

9:00 A.M.—10:00 P.M. Scientific exhibit, Astor Galiery.

9:30 A.M. Case reports:

1. Simplicity of Appliance Used in Conjunction With Myofunctional Therapy for the Treatment of a Distoclusion Case Complicated by Mouth-Breathing.

2. Simplicity of Appliance Used in Conjunction With Myofunctional Therapy for the Treatment of a Mesioclusion Case.

By William J. Speers, Boston, Mass.

10:00 A.M. Paper: Importance of the Individual Tooth. By Albert W. Crosby, New Haven, Conn. Discussion by Henry C. Ferris, New York.

11:00 A.M. Paper: New Developments in Cinematography as an Aid in Education and Science. By Henry Roger (by invitation), Rockefeller Institute of Medical Research, New York.

12:00 NOON. Report: A Visual Presentation for the Patient of the Importance of Dental Services. By H. B. Taylor (by invitation), Toronto, Canada.

12:30 P.M. Past presidents' luncheon.

Afternoon Session

2:00 P.M. Paper: Normal Variation in Human Structures Including the Jaws and Teeth, With Special Regard to Orthodontics. Ales Hrdlicka (by invitation), Curator, Division of Physical Anthropology, Smithsonian Institution, Washington, D. C. Discussion by Milo Hellman, New York.

3:00 P.M. Case report: The Report of the Simplification of the Treatment of Laterally Placed Mandibles. By Earl F. Lussier, San Francisco, Calif.

3:30 P.M. Paper: Idiopathic Root Resorptions in the Light of Recent Investigations. By Hermann Becks (by invitation), George Williams Hooper Foundation, University of California. Discussion by Clay R. Murray (by invitation), Columbia University; Irving H. Pardee (by invitation), Columbia Presbyterian Medical Center.

4:30 P.M. Announcement of the Third International Orthodontic Congress. By W. W. Woodbury, Halifax, Nova Scotia.

4:45 P.M. Executive session.
Reports of Committees.
Reorganization, Amendments to Constitution and By-Laws.

Evening Session

7:30 P.M. Executive session continued.

9:00 P.M.—10:00 P.M. Radio broadcast, National Broadcasting Co.

THURSDAY, MAY 2, 1935

Morning Session

9:00 A.M.—10:00 P.M. Scientific exhibit, Astor Gallery.

9:30 A.M. Paper: A Comparative Functional Study of the Muscles of Mastication in Human and Monkey. By Harry H. Shapiro, Columbia University, New York.

10:00 A.M. Paper: The Temporomandibular Articulation. Its Consideration in Diagnosis. By Sidney E. Riesner, New York. Discussion by W. Ed. Chamberlain (by invitation), Temple University.

11:00 A.M. Paper: The Rôle of Remedial Speech Training in a Program of Orthodontic Treatment. By Elizabeth McDowell (by invitation), Associate Professor of Speech, Columbia University. Discussion by Letitia Raubicheck (by invitation), Director of Speech Improvement in New York City schools.

12:00 NOON. Report: Dental Changes in Rat With the Maxillary Right First and Second Molars Removed. By Sumter S. Arnim (by invitation), Fellow, Yale University Medical School.
Announcements.

12:30 P.M. Luncheon and executive session of New York Society of Orthodontists. Election of officers, members, and other business.

Afternoon Session

2:00 P.M. Educational clinics.

1. Gnathostatic Diagnosis. By B. E. Lischer, St. Louis, Mo., and Ralph Waldron, Newark, N. J. Assisted by Allen H. Suggett, San Francisco; Frederic T. Murlless, Jr., Hartford; O. W. Brandhorst, St. Louis; Leonard Kohn, Brooklyn; Richard W. Lowy, Newark; Eugene J. Kelly, Trenton, N. J.; F. W. Nash, Scranton, Pa.; Paul W. Hoffman, Washington, D. C.
2. The Edgewise Arch Mechanism. By Allan G. Brodie, Chicago.
3. Spot Welding of Chrome Alloys. By Archie B. Brusse and J. Lyndon Carman, Denver.
4. Technic for Roentgenographic Examination of the Temporomandibular Articulation. By Sidney E. Riesner, New York.
5. Atrophic and Dystrophic Bone Changes and Their Importance to Orthodontic Problems. By Hermann Becks (by invitation), George Williams Hooper Foundation, University of California.
6. The Anatomy of the Temporomandibular Articulation. By Harry H. Shapiro, College of Physicians and Surgeons, Columbia University.
7. Demonstration of Clinical Technics Used in the Speech Clinic of the Orthodontic Department, School of Dental and Oral Surgery, Columbia University. By Elizabeth McDowell (by invitation), Columbia University; assisted by Miss Ernestine Blum and Miss Louise Garger.

Evening Session

7:00 P.M. Banquet.

FRIDAY, MAY 3, 1935

Morning Session

9:00 A.M.—6:00 P.M. Scientific exhibit, Astor Gallery.

9:30 A.M. Case reports:

1. Seven Years After Treatment.
2. Result of Treatment After Extraction of Four Premolars.

By S. Stuart Crouch, Toronto.

10:00 A.M. Paper: Observations on the Tempo of Growth. By Franz Boas (by invitation), Professor of Anthropology, Columbia University. Discussion by Milo Hellman, New York.

11:00 A.M. Paper: Standards for Orthodontic Materials. By Wilmer Souder (by invitation), Chief Dental Laboratory, Bureau of Standards, Washington, D. C. Discussion by Harry E. Kelsey, Baltimore.

12:00 NOON. Case reports:

1. Report of a Case of Neutroclusion With Mesioversion of Maxillary First Permanent Molars.
2. Report of Two Cross-Bite Malocclusions in the Same Family.

By Leland R. Johnson, Chicago.

12:30 P.M. Luncheon and executive session of the Eastern Association of Graduates of the Angle School of Orthodontia.

Afternoon Session

2:00 P.M.—5:00 P.M. General Clinics:

1. Models Showing Results of Treatment of Impacted Teeth, and an Adult Case, Aged 33. By Leslie P. Abbe, Hartford, Conn.
2. A Motor Driven Model Trimmer. By Ernest N. Bach, Toledo, Ohio.
3. A Technic for Handling Chrome Alloy Materials. By Brooks Bell, Dallas, Texas.
4. The Advantages of the Use of the Universal Orthodontic Lock for Both Labial and Lingual Arches. By Hugh T. Berkey, Fort Wayne, Ind.
5. Mixing Cement for Orthodontic Bands. By Sydney W. Bradley, Ottawa, Ontario.
6. Spot Welding of Chrome Alloy. By Archie B. Brusse and J. Lyndon Carman, Denver, Colo.
7. Guide Planes, Showing Some Designs We Have Used Leading Up to the Present Type. By Winston P. Caine, Chattanooga, Tenn.
8. Orthodontic Home Service. By Walter Coolidge Chapin, New York.
9. Orthodontic Appliances and Dental Caries. By H. K. Cooper, Lancaster, Pa.
10. Edgewise Arch Mechanism. A Group Clinic on Technical Procedures Directed by Robert H. W. Strang.

Band Forming Technic. By Ralph P. Howarth, Cleveland, Ohio.

(a) The Importance of Placing the Tie Bracket Bands in Their Correct Location.

(b) The Importance of Locating the Molar Sheath Correctly. By Frank A. Gough, Brooklyn, N. Y.

Making the Diagram Guides for the Ideal Arch Wire Form. By Glenn H. Whitson, Brooklyn, N. Y.

Taking Measurements for the Ideal Arch Wires: Maxillary and Mandibular. By Helen A. Gough, Brooklyn, N. Y.

Forming the Maxillary Arch Wire on the Diagrams. By Will M. Thompson, Jr., Pittsburgh, Pa.

Forming the Mandibular Arch Wire on the Diagrams. By Morse R. Newcomb, Cleveland, Ohio.

The Primary Adjustment of the Arch Wire to the Case. By Albert Johnson, Portland, Maine.

Indications for the Round and for the Edgewise Arch Wires. Edward R. Strayer, Philadelphia, Pa.

Tying Ligatures by Hand and With the Ligature Tying Pliers. By Leon D. Bryant, Syracuse, N. Y.

Tip Back Bends in the Arch Wire. By Walter M. Dunlap, East Orange, N. J.

Torque Adjustments in the Arch Wire. By Chester F. Hummel, Rochester, N. Y.

Rotating Auxiliaries. By Clayton A. Sayers, Syracuse, N. Y.

The Vertical Spring Loop Auxiliary. By Robert H. W. Strang, Bridgeport, Conn.

11. Orthodontic Lingual Arch Technic, Showing a Simplified Method of Construction, the Anchor Posts Being Formed From the Arch Wire by Means of Special Pliers. Adaptable to Use of Either Precious Metals or Chrome Alloy. By Walter H. Ellis, Buffalo, N. Y.
12. Reversible Bite Plates. By Herbert H. Ernst, New York.
13. A Technic to Expand the Sphere of the Orthodontist. By Henry C. Ferris, New York.
14. Clinic From the Department of Orthodontics of the Forsyth Dental Infirmary for Children, Boston, Mass.
15. Simplified Method of Impression Removal for Indirect Band Technic. By Harry A. Galton, Orthodontic Department, Columbia University.
16. Technic for the Use of Kroloy in Appliance Construction. By Floyd E. Gibbin, Buffalo, N. Y.
17. Appliances Adapted to Organic Function for Support and Health of the Dental Tissues. By Clifford G. Glaser, Buffalo, N. Y.
18. (a) Some Illustrations of What Looks Like Definite Proof of Correct Treatment of Malocclusion.
    (b) Straightening Up Third Molars by Use of the Spring With Round Tube Attachment Cemented to the Occlusal Surface of the Tooth. By George W. Grieve, Toronto, Canada.
19. Presentation of Completed Cases Showing the Application of Resilient Arch Assemblage as Mechanical Therapy in Various Applications. By Edward Mason Griffin, New York.
20. Expansion by Means of a Loop Spring Force. By Geneva E. Groth, Philadelphia, Pa.
21. Adult Orthodontic Treatment. By F. E. Haberle, Chicago, Ill.
22. Unusual Cases With Missing or Supernumerary Teeth. By Fred A. Hager, Johnstown, Pa.
23. A Practical Technic for the Duplication of Orthodontic Casts. By Axel L. Hanson and Clare K. Madden, Orthodontic Department, Columbia University.
24. A Correction for Thumb and Finger Sucking Habits. By A. F. Heimlick, Santa Barbara, Calif.
25. (a) Demonstrating an Easy Method of Remaking the Lingual Arch Without an Impression.
    (b) A Molar Lock for the Lingual Arch in Chrome Steel Alloy.
    (c) A Combination Rotating Spring and a Lock for the Molar in Chrome Steel Alloy. By Norman L. Hillyer, Brooklyn, N. Y.
26. The Treatment of Impacted Central Incisors. By Burton A. Hoffman, Buffalo, N. Y.
27. A Gold Soldering Technic for Stainless Steel Molar Bands—Arches and Attachments. By W. P. Hoffman, Washington, D. C.

28. Application of Coil Springs in Individual Tooth Movement. By Harry L. Hosmer, Detroit, Mich.
29. Class II Cases With Appliances. By Horace L. Howe, Boston, Mass.
30. (a) Strong and Accurate Repair for a Break in the Lingual Arch in Front of the Half-Round Post.
    (b) A Simple Appliance for the Correction of Unilateral Mesiodistal Malrelationship. By Ashley E. Howes, New Rochelle, N. Y.
31. Bite Planes—Fixed and Removable—the Removable to Be Used Under Certain Conditions in Conjunction With Fixed Appliances. By Andrew Francis Jackson, Philadelphia, Pa.
32. The Utility of the X-Ray in Orthodontia. By Leland R. Johnson, Chicago, Ill.
33. A Simple Method for Control of Unilateral Expansion. By S. L. Kregarman, New York.
34. Correcting a Cross-Bite for a Two Year Old. By A. J. Labbe, Lansing, Mich.
35. A Balanced Reciprocal Arch for the Final Adjustment of Anterior Teeth. By Norris C. Leonard, Baltimore, Md.
36. Demonstration for Constructing Craniocephalic Records. Herbert I. Margolis, Boston, Mass.
37. Indications for Second Permanent Molar Extractions. By H. C. Metz, Pittsburgh, Pa.
38. Application of a New Spring Gauge to Appliance Design. By George R. Moore, Ann Arbor, Mich.
39. A Presentation of Four Varied Cases of Malocclusion, Treated According to Dr. Milo Hellman's Method and Technic, Showing the Appliances Used Throughout the Treatment. By M. A. Munblatt, New York.
40. Orthodontia as a Follow-Up Treatment in Advanced Pyorrhea Cases. By F. W. Nash, Scranton, Pa.
41. Continuous Tooth Eruption as the Determining Factor in the Changes of the Plane of Occlusion (Excessive Overbite, Edge-to-Edge Bite, Open-Bite). By Egon Neustadt, New York.
42. Bite Planes. By Homer Anson Potter, Kansas City, Mo.
43. (a) Closing Spaces for Missing Maxillary Lateral Incisors, Camouflaging the Substituted Canines.
    (b) Chain Spurs for Ligatures or Support of Auxiliary Springs. By Herbert A. Pullen, Buffalo, N. Y.
44. Indirect Band Forming Technic. By F. C. Rodgers, St. Louis, Mo.
45. A Method for Locating Points and Applying Mouges in Gnathostatics. By Walter J. Sly, Boston, Mass.
46. A Series of Roentgenograms Showing Result of Treatment of an Impacted Maxillary Canine and Resorbed Central Incisor. By Allen Everett Scott, San Francisco, Calif.
47. (a) Various Uses for Stainless Steel Ligatures.
    (b) Occipital Anchorage. By Ralph William Short, Boston, Mass.
48. What Every Parent Should Know. By D. S. Sterrett, Erie, Pa.
49. Two Types of Preventive Orthodontia. By Ira B. Stilson, Providence, R. I.
50. Efficient Orthodontic Band Technic. By Earl W. Swinehart, Baltimore, Md.
51. Exhibiting Appliances, Casts and Data Dealing With Closing Spaces, Under Dissimilar and Aggravating Circumstances (at times necessitating extensive tooth movement through the alveolar process). By Hugh Grun Tanzey, Kansas City, Mo.
52. Various Types of Malocclusion Which Confront the Orthodontist. By Arthur C. Totten and Edward G. Murphy, Orthodontic Department, Columbia University.

53. An Improved Solder for Chrome Alloy. By Charles J. Vosmik, Cleveland, Ohio.
54. The Manipulation and Adjustment of a Cranium Immobilizer When Using the Roentgen Ray for the Purpose of Orthodontic Diagnosis. By Ralph Waldron, Newark, N. J.
55. Simple and Helpful Attachments to Present Appliances. By Raymond L. Webster, Providence, R. I.
56. Preventive Technic and End-Results. By R. C. Willett, Peoria, Ill.
57. (a) An Improved Interchangeable Labial Attachment for Steel Alignment Arches, Giving Positive Control.
    (b) A Simplified Lingual Lock.
    (c) An Instrument for Determining and Equalizing Forces Applied to Individual Teeth by Alignment Arches and Otherwise. By Landis H. Wirt, South Bend, Ind.
58. A Simplified Molar Band Technic. By A. Wolfson, Newark, N. J.
59. Observation and Treatment. By W. W. Woodbury, Halifax, N. S.
60. Points on the Manipulation of the Edgewise Arch. By Chester J. Wright, South Bend, Ind.

The American Board of Orthodontia

Created by the American Society of Orthodontists, 1929. Incorporated, January, 1930, State of Illinois, U. S. A.

A meeting of the American Board of Orthodontia will be held at the Waldorf-Astoria Hotel, New York, on April 29.

Those orthodontists who desire to qualify for a certificate from the Board should secure the necessary application form from the secretary. The application must be returned to the secretary, together with any other required credentials, at least sixty days prior to date of examination. In order to expedite the examinations the secretary will designate the hour at which the applicant may appear before the Board. Applications filed at the time of Board meeting will have preliminary consideration, so that applicant may be advised of work required for his subsequent examination.

Attention is called to the following resolutions adopted by the Board:

Any person desiring to make application to the Board for a certificate shall have been in the exclusive practice of orthodontia for a period of not less than five years or an equivalent to be determined by the Board and based upon the following conditions:

First. An instructor in orthodontia in a school satisfactory to the Board.

Second. An associate in the office of an orthodontist whose standing is satisfactory to the Board.

It is, however, to be understood definitely that any person at the time of making application for a certificate shall be in the exclusive practice of orthodontia in his own name.

A luncheon or dinner meeting of those orthodontists who have received the certificate of the American Board of Orthodontia will be held some time during the meeting of the American Society of Orthodontists. Members will be notified of the time and place.

ALBERT H. KETCHAM, President,
Republic Building,
Denver, Colorado.

OREN A. OLIVER, Secretary,
Medical Arts Building,
Nashville, Tennessee.

New York Society of Orthodontists

The fourteenth annual meeting of the New York Society of Orthodontists will be held in conjunction with the meeting of the American Society of Orthodontists at the Waldorf-Astoria Hotel, New York, April 30 to May 3.

A business session for the election of officers, etc., will be held Thursday, May 2, at a luncheon.

FREDERIC T. MURLLESS, JR., President,
43 Farmington Ave.,
Hartford, Conn.

FRANKLIN A. SQUIRES, Secretary-Treasurer,
Medical Centre,
White Plains, N. Y.

The Eastern Association of Graduates of the Angle School of Orthodontia

The Eastern Association of Graduates of the Angle School of Orthodontia will hold an executive session during the meeting of the American Society of Orthodontists. Luncheon on Friday, May 3, at 12:30 p.m., at the Waldorf-Astoria Hotel, New York.

E. SANTLEY BUTLER, Secretary
576 Fifth Avenue
New York, N. Y.

European Orthodontic Society

The European Orthodontic Society will hold its meeting at the Langham Hotel, London, W. 1, on July 29 and 30, 1935, with Dr. Sheldon Friel as its President. Many eminent European orthodontists have signified their intention of being present and reading papers or giving clinics and demonstrations. They look forward to a very interesting meeting, as there is a marked and growing desire to acquire knowledge of this fascinating subject.

The meeting will be immediately followed by the annual meeting of the American Dental Society of Europe, and it is expected the attendance will be a large one. Doubtless, when the final arrangements are made, there will be an exchange of hospitalities between the two societies, which was the arrangement of the last meeting at Scheveningen, The Hague, in May, 1934.

The European Orthodontic Society, by invitation from the Secretary, Mr. G. F. Cale-Matthews, is very eager that co-patriots of America attend this meeting and contribute to the program.

The officers of the European Orthodontic Society at the present time are as follows: President, E. Sheldon Friel, Dublin; Vice President, H. E. March, Bexhill, England; Secretary, G. F. Cale-Matthews, London; Editor and Treasurer, O. Henry, London. Board of Censors: J. T. Quintero, Lyon; F. Stuhl, Paris; E. D. Barrows, London.

Extension Orthodontic Course at Columbia

A special course in orthodontics has been outlined and announced under the University Extension Courses of Columbia University, and is scheduled to be held for the week preceding the annual meeting of the American Society of Orthodontists. The course will be given by Dr. John Mershon and his assistants. Members of previous classes are invited to participate in the sessions held during the last two days of the course.

Southern Society of Orthodontists

The fourteenth annual meeting of the Southern Society of Orthodontists will be held at the Signal Mountain Hotel, Chattanooga, Tenn., on September 30, October 1 and 2.

Members of the dental and medical professions are cordially invited.

WINSTON P. CAINE, President,
Medical Arts Building,
Chattanooga, Tenn.

WILLIAM P. WOOD, JR., Secretary,
442 W. Lafayette Street,
Tampa, Florida.

Dental Society of the State of New York

The Society will hold its Sixty-Seventh Annual Meeting June 12-15, 1935, at Saranac Inn, Upper Saranac, N. Y.

A cordial invitation is extended to all ethical dentists to attend the sessions.

DR. AUGUSTAVE NEUBER, President
619 Union Street,
Schenectady, N. Y.

DR. A. P. BURKHART, Secretary
57 E. Genesee Street,
Auburn, N. Y.

Northern Atlantic Orthodontic Society

The next meeting of the North Atlantic Orthodontic Society will be held Wednesday, April 24, at 8 p.m. at the Knights of Columbus Building, Brooklyn, N. Y. Dr. J. N. Pike of Minneapolis will present a paper on "The Value of the Practice of Adult Orthodontia to the General Practitioner in Correlation With Prosthesis." Dr. Wm. McGill Burns will discuss the paper. Table clinics will follow.

TALBOT H. LEBLANC, Secretary
515 Ocean Avenue
Brooklyn, N. Y.

Postgraduate Course in Orthodontia in Toronto

A postgraduate course in orthodontia for the general practitioner has been announced by the faculty of dentistry, University of Toronto, for a duration of two weeks. The object of this course, as explained, is to give to the general practitioner of dentistry who is interested in the subject of orthodontia a short and intensive course which will improve his ability to make a diagnosis, enable him to select cases in which he would be justified in undertaking treatment, prepare him to make the necessary appliances and give the patients satisfactory treatment. The course is under the direction of Chas. E. Carrigen, C. Angus Kennedy, and S. Stuart Crouch.

Pacific Coast Society of Orthodontists

Central Section

The Central Section of the Pacific Coast Society of Orthodontists met December 11, 1934, in San Francisco. The Nominating Committee selected Dr. S. McCowen as chairman, and Dr. Diment was selected to continue as Secretary-Treasurer.

The principles of levers in their application by the lingual arch to the long axis of the teeth was theoretically explained very thoroughly by Dr. F. Epley, and shown graphically by several comprehensive drawings made by him.

Dr. Lussier showed complete records to be kept of all cases, on history, diagnosis, treatment, retention, etc. Dr. Lussier also gave a brief history of the lingual arch and its origin and showed several cases wherein its use was indicated.

Dr. A. Scott explained the method of using the lingual arch in straightening an impacted second molar.

Dr. Fred Wolfsohn presented several models showing a method of expanding or enlarging the lingual arch wire with the use of loops just anterior to the molar attachments, thereby insuring an easy adaptation of the main arch wire as the dental arches were expanded.

Dr. J. Camp Dean presented a case of an impacted canine with several missing teeth in an adult person successfully treated with a lingual arch.

Dr. Harvey Stryker presented an original orthodontic record card upon which he has a complete history, diagnostic, financial and treatment record.

Southern Section

The Southern Section of the Pacific Coast Society of Orthodontists met in Los Angeles, December 14, 1934. Meeting was called to order by chairman Dr. Fred E. McIntosh.

Dr. Furrie read the program of the Pacific Coast Society of Orthodontists to be held in San Francisco, February 14, 15, 16, 1935.

The rest of the evening was devoted to answering of questions sent out to various members from our "Question Box."

"How do you correct and retain open-bite cases?" A very interesting paper was given on this question. Also models were shown before and after treatment of an open-bite neutroclusion case and an open bite Class III case with very satisfactory results.

"When one orthodontist accepts a patient from another and disagrees with the method of treatment, what is the ethical thing to do?" This question brought out quite an interesting and helpful discussion. The importance of handling such cases in a diplomatic manner was stressed.

"During the patient's absence, in case of breakage, if he calls on another orthodontist, who should pay the fee?" The importance of sending a letter of confirmation of verbal agreement to the patient at the time the case was started was stressed. The letter setting forth the responsibilities of the doctor to the patient and the responsibilities the patients themselves must assume, including the payments of all cost for repair of breakage done by another orthodontist during their stay in some other part of the country.

"What procedure should be followed when a patient moves to another section of the country to continue treatment?" This also brought out an interesting discussion, clearly setting forth the importance of giving the history and available data to the doctor who is to continue the case, also the importance of sending all appliances, models and x-ray pictures directly to the doctor, rather than giving them to the patient.

"In case it is necessary to remove a mandibular or maxillary first permanent, is it considered good practice to have the same member removed on the opposite side of the arch at the same time to bring about a balance?" A better working occlusion and a better balance would be derived from such a procedure.

"Do you think the third molar can cause a detrimental pressure to the arch anterior to its position?" The opinion was that it often did.

"Do you consider it good practice to extract the maxillary first premolar in certain definite cases?" The opinion was that in certain types of cases such extractions were indicated.

The office of chairmanship was accepted by Dr. C. E. Thompson and that of secretary-treasurer by Dr. A. F. Heimlich.

Testimonial to Dr. Ottolengui by the Dental Profession

The dental profession is to express in a material sense its debt to one of the profession's most unselfish, tireless and accomplished workers. A movement has been started to recognize the seventy-fifth birthday of Dr. R. Ottolengui through the medium of a fund to be raised among his many friends and admirers in the profession.

Over forty-one years of service as an editor; author of books, both dental and fiction; contributor of chapters to several recognized textbooks on dentistry; lecturer, clinician, inventor, contributor of his time, thought and personal fortune to the advancement and for the general welfare of the profession in all of its phases, he has earned the gratitude and appreciation of all who believe that unusual service should merit recognition.

To those contributing $5.00 or more to this fund, the committee proposes to send a copy of a special edition of Dr. Ottolengui's book, *Table Talks on Dentistry*, with an engraved facsimile of the author's autograph on the first page. This and the special marking of the book will identify it and always serve as a reminder of your active participation in this well-earned tribute. Please mail check or money order to the Ottolengui Testimonial Committee, 1 Hanson Place, Brooklyn, N. Y. The active participation of members of the dental profession from all over the country is hoped for. The Committee thanks you for your generous support.

Dr. W. D. Tracy, Honorary chairman,
Dr. J. R. Schwartz, Chairman.

Note of Interest

Dr. George F. Bowden announces that Dr. Fred G. Bowden is now associated with him in new offices at 1107 Republic Building, Denver, Colo. Practice limited to orthodontia.